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Table of Contents

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List of Figures

Abstract

The computer animated re-enactment has infiltrated the legal system in the United States and is making its way into Canada. As a tool for forensic scientists and Police officers, re-enactments have proven to be a beneficial tool in summarizing data into a visual representation of the facts. Currently, animation is starting to have a more public presence; it is being used in courtrooms as demonstrative evidence. Technologists and some lawyers are interested in getting re-enactments of this type admitted into the court, but little research has been done on the effect of animation on people's judgement. Therefore, controversy over animation as an information tool or prejudicial embellishment is beginning to grow. Psychology, Film and Law need to be studied to understand their relationship to this problem, and their relationship to each other. This thesis examines the elements of motion, texture and lighting within animated film to see if viewers are influenced and how these influences may change a jury's collective mind.

Introduction

As humans we interact with many complex systems which are made up of subsystems formed by patterns which can be more easily understood. These patterns are marked by interactions with areas often unrelated but no less influential on each other (Casti, 1995). Examining animated re-enactments of crime scenes involves a complex system made up of subsystems which include the studies in: the perception of image, information delivery to a jury, and film and the audience. There is a need to integrate these studies when considering the effect of re-enactments on a jury. We must examine the system and the interaction with people which make it complex.

As we look at the world our mind fluctuates between a state of focused and often non-focused attention. We move in and out of acute awareness (i.e. to catch a football) and unconscious viewing (i.e. of cars which pass by) we accept these perceptions of motion to be controlled equally in our brain. Another way in which we perceive motion is through animation or a series of images that change over time. If we view the images very quickly (24 images per second or faster) our eye is tricked into seeing the images as motion. Roget describes an occurrence called "persistence of vision" (Peter Mark Roget in 1824) as one image is suspended in our minds for a fraction of a second, just long enough for the next image to appear. This occurrence, with a number of images, gives the illusion of motion. Our brain uses different processes to understand motion. If we are familiar with the particular animation or any series of moving images, our brain efficiently recalls and discards this information so we can focus on less familiar information, such as the way a character looks, the name of the person we are meeting, or how much money we have in our pocket for lunch.

> We see, therefore, reminiscences of previous experience act in conjunction with present sensations to produce a perceptual image (auschruungsbild) which imposes itself on the faculty of perception with overwhelming power. Without our being conscious of how much is due to memory and how much to present perception (Helmholtz, pg.181)

A motor vehicle accident or criminal activity may be experienced only a few times in our lives, but, because they are unfamiliar sequences, we are very conscious of the motion and events which take place. Despite our heightened awareness, because we are less familiar with these activities and their specifics, we can be more easily tricked by what we perceive to be viewing. Our past experiences allow us to recall and make better judgments about events but we also rely on our experiences to efficiently process information and quickly discard the familiar. This is not to say that the eye and the brain are inferior tools. It is a matter of how we process visual information so that it is economical for our brain but also fills in what we anticipate to be true. Often we believe we anticipate correctly. If we purposefully change the qualities of animation so that our minds will not easily discard the information, this should enhance our ability to recall an event. For the purposes of re-enacting crime scenes, animation can alter viewing elements yet still illustrate the events similar to a verbal description. Could we then verbalize our perception more accurately and make better judgments, or do the realistic qualities of an animation affect our ability to make judgments impartially?

This research is a comparative study of animations, rendered at two different levels of realism, to describe a murder case. The animation depicts the scenario argued by the defence. Thus, judgments are based on the element of realism and its qualities. I was intrigued by the use of demonstrative evidence in a court room after reading an article in the *Review of Litigation* journal.

> If evidence is offered as a demonstration of a scientific principle, the conditions of the experiment must be at least similar to those which existed at the time of the accident. However, if the evidence attempts to re-create an event rather than illustrate physical properties, the recreation must be nearly identical to the original event. (Clancy Jr., pg. 208)

The article described the stance taken by judges on the issue of demonstrative evidence in an argument favouring animated simulations. The article went on to explain that judicial procedure would benefit from animation because it can demonstrate complex ideas quickly and more effectively than a traditional verbal description. Generally, where the use of video is accepted as evidence, the relationship of the video to the particular incident is vague, general and misleading. For example, current simulations which are admissible may not be "simulation" at all. In an article on demonstrative evidence a description of a motorcycle's driving path was critical in understanding who was at fault in a motor vehicle collision. The real incident occurred on a banked curve, at night, while it was raining. The angle at which the driver had to lean the motorcycle to turn the corner and the speed would vary. The simulation on video tape which was allowed as admissible, showed an actor on a motorcycle, on flat pavement, on a sunny afternoon, at an approximate speed to execute a left turn. Even though this was not a true representation of the incident it was nevertheless allowed as evidence in court. Why not recreate the incident to resemble more closely the known conditions?

Animations used to simulate accident and crime scenes have traditionally been of low quality because of technical and time restraints. Although the descriptions of the animations were more accurate, the recount of the incident was less realistic. Would improving the quality of animation address both problems? What effect, if any, would this have on a jury? Although the author in the journal was a proponent of animation in the courtroom he had no evidence himself of either its benefit or its negative impact.

There are three disciplines which need to be explored in order to look at the effect of animation on a jury: psychology, in order to understand the visual effect on our ability to make judgments; visual communication, in order to analyse *animation* and its elements, such as quality in image and accuracy in depicting a real world scenario; and Law, in order to define the possibilities and limitations for the use of animation in a courtroom or as an investigative tool by police departments. Through examination of these disciplines I found that the question of how much we are influenced, if at all, by animated re-enactments had gone unanswered. I realized that a clear hypothesis needed to be tested: "juries are persuaded by a more realistic depiction of a crime scene than by a less realistic one." Within each of the three disciplines mentioned above there are a number of problems that are immediately apparent. What is the relationship between the viewer and the film? What are the current structures of law around the use of evidence of this type?

In order to test this question, survey groups, which represent typical jury members, were asked to make judgments on the events which they have seen, helping to reveal some understanding to the questions of perception, judgment and realism using animated re-enactments.

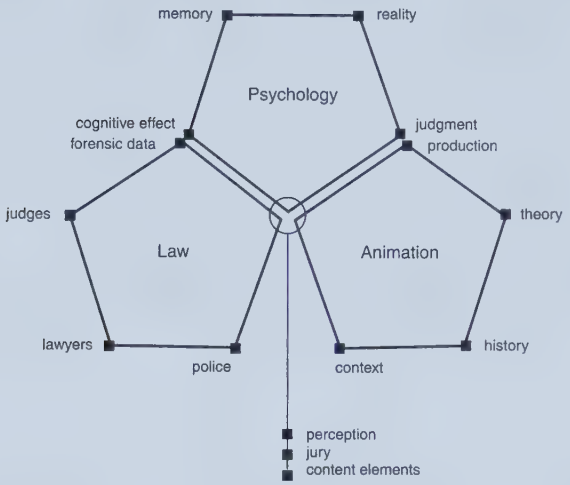
If the study should show that the influence animation has over a jury interferes with their ability to make logical decisions and adds to their emotionally based judgment, we must consider the use carefully. If these influences are significant we should no longer challenge the court to set precedent in allowing animation as demonstrative evidence. It is difficult to definitively answer all the questions surrounding the subject, and further study is needed to ensure that challenge is not halted, or allowed to continue prematurely.

Splitting the duties -- building a framework

Speaking as a designer, what is the impact on the process and outcome from connecting the unlikely partners of film and law? This connection and others of film and perception lead to the work of Jeffery Johnson in *Multidimensional Networks of Complex Systems* which describes an organization of understanding using a "hierarchical backcloth". This is a model of known adjacency using subsystems which are currently understood or now operate within a local structure with which we need to become familiar. It is a cumulative process of all these subsystems coming together from a reductionist basis of knowledge gathering in the research phase of the

problem. Once the adjacencies of the hierarchies are established, a hierarchy of traffic flow between adjacencies also becomes part of the backcloth. As visual communicators we often start with the subsystem of form, of content, a business, an audience or a computer, but we need to continually form the hierarchy of adjacencies to understand the relationships and the lesser known effect on one another. (Johnson, 1995)

Figure 1

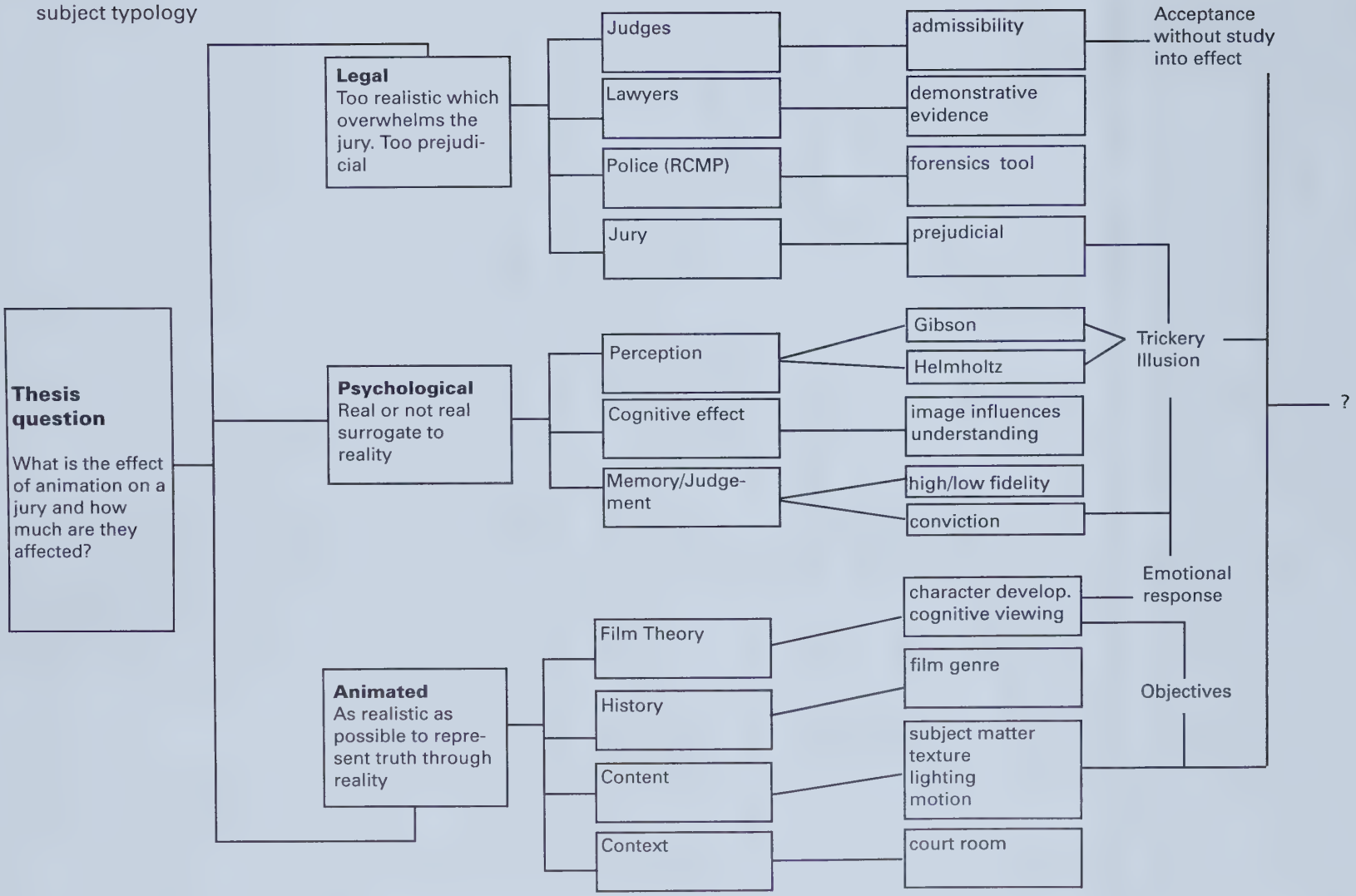


adjacency 1 cognitive effect relative to forensic data and visual perception to the jury

adjacency 2 judgement relative to production elements and jury to the content (see Appendix 1)

Investigation of the three subsystems, within the larger complex system, reduces the unknowns and helps to define the specifics of legal, psychological, and animated disciplines. From the lower points of the topology, a new hierachical structure derives from the questions answered in this thesis and the relationships of one subsystem to another as they become established. The position of the relationships on the new structure are determined by how influential they are to the complex system as a whole. This topology (see Fig. 2) acts as the backcloth, organizing unrelated subsystems and the adjacencies described in the thesis.

Figure 2
subject typology



A description of the crime

as reported by the RCMP

In early spring, on a farm yard in Western Canada, a farm-hand was working and living at the home of a friend. His girlfriend was also staying at the home for the weekend. The farmer and owner of the property had left the house to run an errand in the nearest town approximately 20 km away. The two had reportedly been drinking at 11:00 am that morning when the farmer had left. Earlier in the week a former boyfriend of the girl had made a number of threatening phone calls. He had said he was going to kill the girl and her new boyfriend (the farm-hand). At approximately 4:20 pm the estranged boyfriend drove up to the farm house and approached the front door. The girl met him outside underneath the car port. An argument ensued and progressed to a scuffle. As a result the girl was pushed to the ground. The attacker then approached the house where the farm-hand had remained. During the scuffle the farm-hand had gone to the bed of the master bedroom and retrieved a 44 calibre hand gun, which was the registered property of the farmer. He was aware of the gun's location because he had slept in the bed two nights earlier. He had noticed an irregularity in the mattress and had found the gun hidden between it and the box-spring. The farm-hand had reported that, as the estranged boyfriend crossed the threshold of the door, he, the farm-hand had fired the first shot to warn his attacker. It was also stated that the estranged boyfriend did not have a weapon in his hand at the time, although he did have a hunting knife, in a holster, in his possession. After the estranged boyfriend continued to advance the farm-hand shot a second time hitting the boyfriend in the left side. The bullet continued to pass through him, exiting his back and passing through the front door, striking the back of the girl's head and killing her. The bullet stopped at the bridge of the victim's nose. She died of those injuries. The estranged boyfriend stopped his pursuit of the farm-hand and tried to attend to his wound, roaming through different parts of the house. The gunman phoned for police and described the events which were recorded in detail to the operator. The animations produced for this thesis were reconstructed based on the phone call, recordings by police and the testimony of the people involved, as well as forensic data gathered by RCMP and the RCMP forensic lab. The estranged boyfriend did not give an account of the incident.

The Psychology

Psychology plays a large role in measuring how animated technologies influence and motivate people to think in a particular way. This study seeks to understand people's perceptions of what they see, and, at the same time, explores the use of animation to induce a preference for a particular technique in telling the story. When comparing a visual demonstration of evidence versus a verbal description of the same evidence, it can be shown that visual communication is a consistent and preferred form of relaying information (Hastie, 1993). This thesis will show that even though animation may be preferable to enhance memory and better describe events, there are variations of style, character, and realistic qualities to consider which should guide its use. To date there is little study being done in this area, and the number of court cases in the United States that use animation for demonstrative purposes is growing. The numbers are lower in Canada, but in the past year the acceptance of animation has increased without questioning its effects.

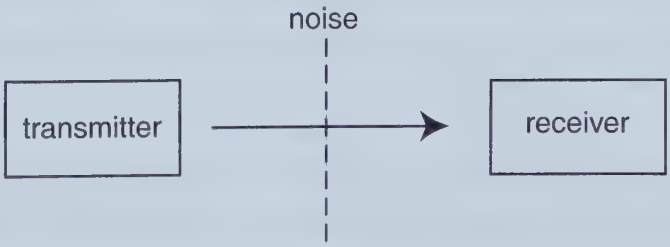
It is also important to understand the psychology of the characters involved so that the animations can include the personal profiles of the individuals they are trying to portray. One can never assume an understanding of the psychological make-up of an individual, but for more realistic simulation an attempt to understand the characters is useful in making choices involving motivation. Assumptions about motivation are important because we base the appointment of penalty on criminal intent and we assume the intent, based on evidence and its connection to motivation.

Literary review on perception

Looking at the psychological implications within this thesis, there are many which form adjacencies to film and law. Two specific relationships which deal with perception exist between the audience and animation (content), and the audience and the law (context).

For the first relationship we must discover if we are affected by realistic images of film. Further, in what way are we affected and how can this be measured? As a communication model for structuring the investigation of these questions the Shannon and Weaver model is an obvious starting point (Weaver, 1949).

Figure 3

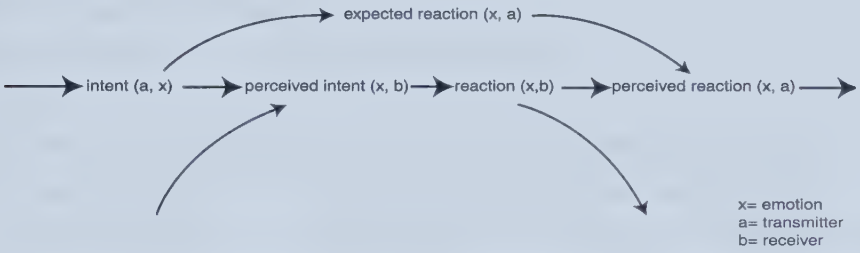


Shannon and Weaver model for communication

Where the transmitter represents the film and the receiver represents the jury, the noise, therefore, must in part be the screen. Noise could also be interpreted as the cultural background of the receiver, or the clarity of the film. This type of noise can interfere, causing mis-communication between the transmitter and receiver. As a descriptor for this kind of communication, it seems adequate for the type of interaction between audience and film although it neither allows for the intent of the message sent nor symbolizes the importance of the interpretation of the message by the receiver (Morgan and Welton as cited by Leif Almendinger, *Teaching Communication Theory*). In order to define the exchange of information from the transmitters (lawyers) and the receivers a better model was needed.

Gailen Bodenhausen, experimental psychologist in group dynamics, explains his model of communication as follows (Bodenhausen, 1988):

Figure 4



Here the transmitter is no longer just the film images but the communicator of the story with expectations of "b" the receiver to understand a code of information through the method of information delivery. The code of information is set out by the prosecution, or the defence, and the animator. The expected reaction is the hypothesis of this thesis. The reaction is quantified in the data results and the perceived reaction is formulated in the evaluation of the data. Although Bodenhausen intended the model to be used in group interactions, it is appropriate because further study will include interactions of jury members in group discussions. The use of this model establishes a consistent methodology for future study and the possibility for comparing data.

The two contexts of communication, both real life and the virtual world, have similarities in regards to visual perception. Bingham (1998) Geoffrey (1998) and Rock (1993) studies in visual perception are commonly cited views of how we perceive motion and how we move throughout our own space. If we look at Bingham's work in terms of making judgments of our own actions, of objects, and of what we believe other people to be doing, there is an accepted level of understanding which is based on guessing. (Bouncing ball experiment, Appendix 3). Because of our experiences in life, we have common interactions with our environment and with people based on physical, social and cultural constructs. We

make predictions about the outcome of our actions, and if they are favourable then we proceed. Howard Margolis refers to this as "stepping" and "checking" in his book *Patterns, Thinking, and Cognition.*

Past processes of perceptions and assumptions about physical, social, and cultural constructs result in what we call life experience. Even though not identical, life experience will be similar for those who are a part of the same society and culture. Because these situations remain relatively constant and we suffer little or no negative consequences from our assumptions, we believe that we make good decisions based on good judgment. This confidence is carried into areas with which we have little or no experience. Many studies on confidence and guessing, particularly in the fields dealing with games of chance, have discussed our propensity to make guesses without implementing logical sequence or even taking an analytical look at incorrect guessing. Where our guesses are incorrect we assume some anomaly to have been the cause of the unexpected resolution of a conflict.

A different point of view

The perception theories of James J. Gibson (1950-84)

Unlike the description I have given on perception, cognition and mind-mapping, Gibson introduces the idea of the optic array or the information inherent in the light reflected back to our eyes from an object. Light, according to Gibson, is the most important element in perception of the real world. He states that we have no stored memory or map of objects, instead, as we age, we become more efficient at recognizing the light, texture, and colour of objects through the analysis of the optic array. The information inherent in light as it reflects back to our eye is instantly processed and discarded. Where there is no reference to past impressions of objects in our minds, it is the objects themselves which generate the information necessary for recognition through the optic array which is reflected by light. In combination with the variance in light from objects, an optic array produced from converging parallel lines of the environment creates a figure-ground relationship so that we understand the objects' position in space. (Gibson, 1963) Animation uses these same components to represent the real world, not contour size or shape, but volume, texture and light.

Where his theory has some difficulty (and where his own thinking has changed) is his notion of still image perception, which relates to both still photographs and motion pictures. Proponents of Gibson's theory also question its implications for the artificial image because the optic array has essentially transfixed a three dimensional space or object by the camera, and because the picture transmits an optic array of two-dimensional qualities. (Hoge, 1989) How then are we able to understand the image in the photo at the same time we are able to understand it as a two-dimensional representation? If we look into the photo we see three-dimensional space. We would be fooled to believe this is, in some way, real. In

order to see the image as photograph and at the same time recognize the three-dimensional space we must recall the optic array of one while engaging in the other.

Gibson's opinion on visual perception is, understandably, controversial because it brings up the question of memory. The processes of memory are separated in Gibson's theory and could be considered more conscious viewing. If we integrate the theory of Gibson with that of the Herman von Helmholtz tradition (mind-mapping) we can address the difficulties of ecological perception in the Holger Hoge "flexibility hypothesis"

> I believe that an internal representation of the picture is made and that this representation, rather than the picture itself , is the aesthetic object. I propose to call this view the 'flexibility hypothesis' of perception and cognition, i.e. we have some freedom in interpreting, and giving meaning to, sensory events. The very speciality of the aesthetic experience is that nearly all kinds of variables may influence this process. (Hoge, pg.106)

The process of how we perceive images, whether through mapping information or through direct information is changed by variables, both visual cues and interpretations. Connecting perception with the meaning we attach to the image is dependent on internal strategies for understanding and external qualities for information transmissions.

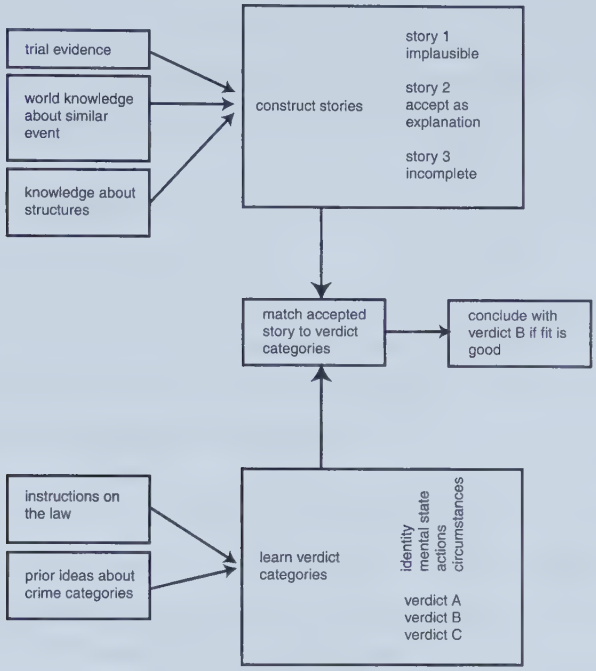
Memory and judgment

How then does this relate to animation and the re-enactments of crime scenes? A cognitive process which leads to making judgments starts with the acquisition of information. To put it simply, we move from visual perception, to memory retention and finally to making judgments. Part of this process will be affected by information quality (Neisser, 1975). If information is stored in the short-term memory, we can sufficiently reflect on the information to form an opinion. We make decisions based on information we receive as well as on our own experiences and our emotional state of mind. All of these affect what we retain and how long we retain it. Studies show that the effect of an image on memory retention, as opposed to verbal description, more than doubles the length of time in which we can recall that information. (Hovland, 1953)

Once we have obtained and stored the information it becomes a part of our mental schema to evaluate events and make judgments. If we look at the following story model by Reid Hastie, which describes a three component process for making judgements by jurors we find the following: (A) evidence evaluation through story construction, (B) representation of the decision alternatives by learning verdict cat-

egory attributes, and (C) reaching a decision through the classification of the story in the best fitting verdict category. (Hastie, pg.192)

Figure 5



Hastie story model for jury decision making, 1993.

It is difficult to say what the proportion of information, experience, and emotional state of mind plays in our decision making, but according to Hastie all three do have some influence. Within this thesis modifications to the model will be made by substituting the animation for the story construct. Comparisons will be made to the implausible, incomplete and the accepted explanation of story 1, 2, and 3.

Conclusions about memory and judgement

If we look to animation as a demonstrative tool we essentially put the juror in the position of eyewitness.

> A major impediment to our search for truth is that the facts to be discovered by our courts are almost always past facts. Our method of discovering them is normally through oral testimony of witnesses who have personal 'knowledge' [which] might perhaps be better described as personal beliefs about what they now remember...Facts found by the court are really then only guesses about the actual facts. (Delisle, pg. 3)

The difference between juror and eyewitness is that the juror has the opportunity to review what was seen multiple times, as well as see from different points of view. The eyewitness of the actual events also has the opportunity to corroborate the evidence which is being presented to the jurors. Multiple viewings may in fact be encouraged to ensure information has the opportunity to become part of the short term memory. The story can be adopted once all the information is seen and/or heard to establish acceptability over time then stored into long term memory.

The psychology of motion perception

Within this thesis there are two other types of motion which I think are relevant to address. The first is camera motion and how the viewer is manipulated by our association to point of view. It is often used as a technique in film, that the camera acts as a surrogate for the viewer, and what is shown to the camera, or done to the camera, is directly internalized by the viewer.

> And it is true that as he identifies with himself as look, the spectator can do no other than identify with the camera too which has looked before him at what he is now looking at and whose stationing determines the vanishing point...his identification with the movement of the camera being that of transcendental, not an empirical subject. (Metz, pg. 49)

This technique works well when the camera is personified by the other actors on the screen or if we have come to know the actors and are sympathetic to them by some universally relevant connection. Then if the actor assumes the camera position as though we are seeing life through his or her eyes, we have a tendency to believe that what happens to the character, either symbolically or realistically, could also happen to us. The reverse may also occur where the antagonist is the hero or heroine. We naturally identify ourselves with characteristics we believe we posses or admire, and because we see the character's power over the others on the screen as if we had attained that power, we can live vicariously through them. You will often see this in action adventure movies. Even after the film, people will repeat physical actions such as martial arts or fight scenes. They identify with the character whether they are the victim or the killer, not because they liked one actor in one movie and the other in another. It depends on how the director has developed the characters and if they want you to feel for them or not. This is done partly by camera motion and it is very useful in manipulating the audience.

The second motion type that I wish to address is the way in which we perceive object motion in space. As mentioned earlier, perception is based on a type of guessing and substantiation of that guessing. Imagine the act of watching a ball being thrown through the air. Now imagine it coming toward you. We can estimate the speed, arch and time of arrival so that we can catch it. This is quite an amazing task for

our brain to accomplish and even more amazing when we introduce our own movement into the mix. Fortunately, when this action is represented by camera motion, the jury members are sitting when they watch the animation. We perceive motion similarly to the construction of animation. Our eyes capture bits of images because they dart about our world view very rapidly. The eye is particularly keen on capturing changes of that world view like shade and shadow and colour variation (Gibson, 1957). If we actually saw everything in all its detail the brain would become overloaded with information. In order for the brain to operate efficiently it takes in a smaller amount of information and discards repetitive information and assumes the rest by guessing (Lappin,1995). Our vast knowledge of the world makes it possible to continue guessing even though we may not have experienced catching the ball in the same way before. It is a similar action to the last time we did it, and, once we have caught it, our experience substantiates once again that our assumptions are correct. The more we do tasks well the more we feel a re-inforcement in our minds that we are doing them correctly.

Within our brain the neurological network fires electrical impulses as we proceed through the work. This creates a path of sorts which is stimulated in a sequence that corresponds to the physical actions. This path becomes more established as we repeat the performance of the task. Learning to play the piano is a good example. A typical beginner is taught note recognition as a methodology so that when the eye is triggered by the notes on the page, the finger strikes the corresponding key. The more often this is practised the easier it is to make the connection between the visual symbol and the action. This is often referred to as muscle memory. The speed at which this takes place becomes so high it seems to bypass the brain. The accomplished pianist can flawlessly play music that they have never seen before. It is also true that accomplished pianists can make mistakes or forget portions of a piece of music which they have been familiar with for years because the conscious mechanics of the playing are so ingrained that details and care may not be attended to with the same scrutiny as it was when playing the piece for the first time.

For the first-time viewer of the animation a similar function of the mind takes place. The focus of attention is acute to the detail with which we are unfamiliar. We quickly dismiss the elements we believe we are familiar with and subsequently ignore them. The awareness is in the general construct of the event and details tend to focus on the particulars of the action.

Motion irregularities in animation - Cueing the viewer

Early attempts at simulating motion through three-dimensional computer environments diminished the quality of animation. When animating a leg taking a step, a complex series of motions takes place. The previous task does not begin to describe the complexity of the walking motion. Animators naturally

assume by repeating this motion with both legs and arm swinging, walking can be simulated. The computer repetition of an action is precise and the motion becomes predictable, to the point of becoming unnatural. The computer re-enacts motion from the real world by repetition of a mathematical equation, saving time and simplifying execution of the animation processes. Animating motion using traditional cell animation takes a long time to generate. The cell animator uses the motion of the body, the head, and the arms to simulate walking, and the variation of these motions adds a human quality. The most recent animated films using 3-dimensional figures still rely on cell by cell motion techniques to simulate the most complex movements.

Using again the example of the accomplished pianist, an untrained ear hears a piece of music which sounds flawless and identical to the last time they heard it; however, no matter how perfect it is played, we know it has varied slightly, due in part to the fingers stroking the keys. The animator's ability to vary key strokes in one finger for every note a character plays is difficult and negates the simplified method for creating action available to him/her via the computer. With inconsistencies such as these, can animated film act as a representation for reality? The more familiar we become with three-dimensional animation the less attentive we become to the inconsistencies with reality. If animation achieves high levels of realism, the easier it will be for us to assume the same understanding of information we now obtain from real world film. Making the leap from the equivalent of real world to surrogate to reality has yet to be seen.

Case study questioning the hypothesis

The question of how we are affected by film and animation specifically came to me while watching a similar case in Nova Scotia, Canada where a man was charged with the murder of his wife. At first he was not a suspect but, because he married soon after his wife's death, people who had testified on his behalf earlier now changed their minds. An animated demonstration of what had happened was created to re-examine the case. I was puzzled by how the animation affected their decision. The witnesses initially spoke the truth, then changed their minds because of circumstantial evidence and returned to the original statement after seeing the animation. Is it more or less difficult to change an opinion after one has been formed? One has an opinion about the case and the defendant before little or any evidence is given. In spite of this, Mr. Justice Canuthers gave a presentation to the Advocates Society Conference (Oct. 22 1994) stating that animation will have a prejudicial effect based on general principles of the Supreme Court of Canada (Gardener, 1996). Is it prejudicial? It seems likely that a visual representation of a crime is more convincing than a verbal description. (Conners 1976). Some preliminary research showed that visual descriptors stay in our memory longer. This alone is prejudicial because it is not about how long something stays in our minds but its significance to question our opinion and its believ-

ability to be true that is important. Therefore, the question became, how prejudiced do we become from viewing the film? If we must concede the fact that it is prejudicial we could also say it has equal but opposite effects for the defence as it does for the prosecution. It could be argued that inherent qualities of film are prejudicial but for the same reasons we could argue that verbal delivery is equally skewed so long as it is consistent. Can we overcome this prejudice by representing the opposing view or by becoming more familiar with the medium so that we understand its potential to overwhelm us? If we look at what degree we are influenced, and the specifics of the influential factors, we might get an answer. Even though Canadian judges have generally disallowed animation as demonstrative evidence in the court room, it has crept its way into hearings, appeals and as an investigative tool, indicating the presence of animation in court rooms might be imminent.

Most research has looked at film in the area of entertainment. Some of my research is based on these findings, but it is important to note that context is an important part of the movie experience. We go to movies for entertainment, to have fun, and according to some research we have a predisposition to do so. (Ellis, 1973). The serious nature of jury duty may be influential on perception. The experience of watching the films in a setting, which could be, and should be, different than the movie house, deviates from the conventions of the movie goer's experience. Considering the subject matter, the people involved in the case, and the relevant impact on the participant, not just as viewer, but also as a jury member, shifts conditions to a serious environment.

Film as illusion - film as reality - tricks and judgement

We have often seen the Muller-Lyer illusion, seen here in Figure 6, as an example of illusions which persist. Even after we understand that both horizontal lines are equal and even after measuring them our perception of them remains unchanged (Seward Barry, 1997).

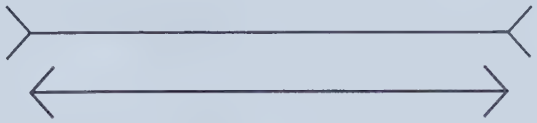


Figure 6 Muller-Lyer illusion

After reading this and other studies which show our over confidence and non-logical sense I found it hard to believe we have made the advancements we have, given the ease with which we can be fooled. (See also Figure 7 and 8). Another study which caused me to wonder about our ability to make judgments from what we see (one drawn to my attention by Dr. Frost at Queens University in Kingston,

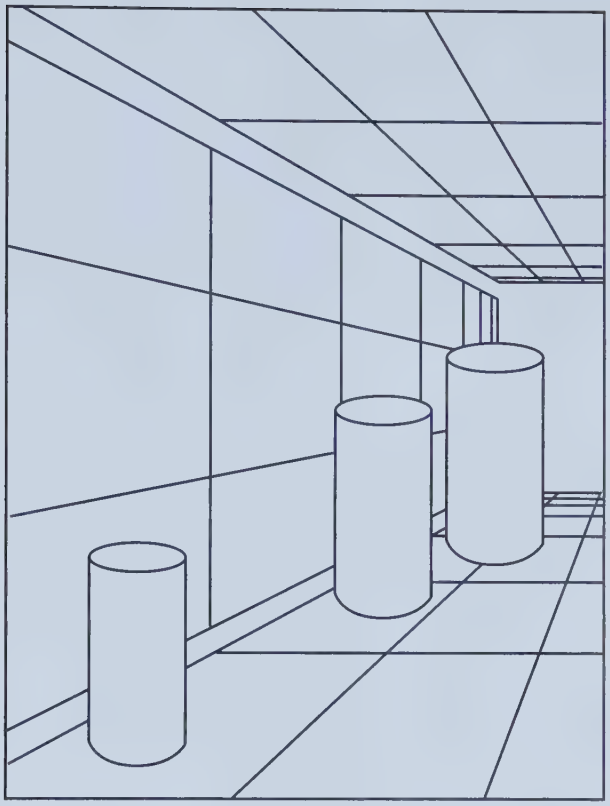


Figure 7 Gibson's illusion tunnel: The cylinders appear to have different heights. They are all the same size

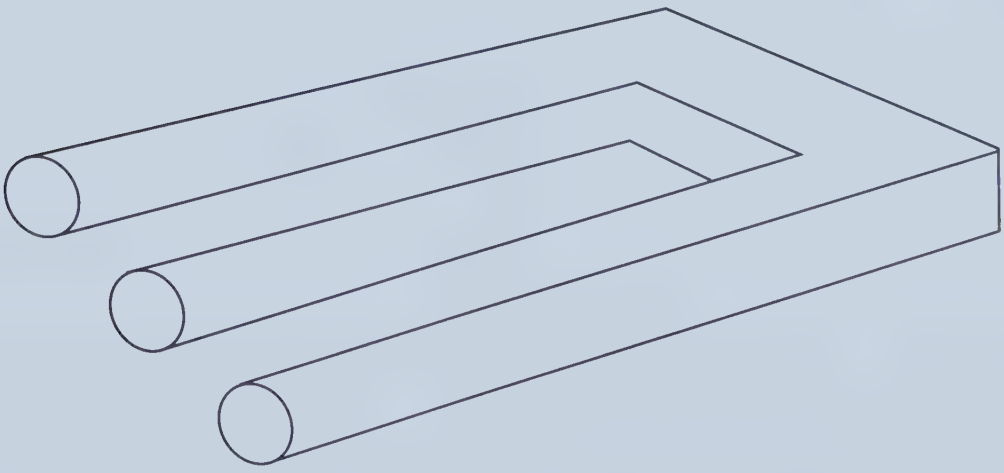


Figure 8 The devils tuning fork: The prongs or the base can be seen as separate sensible parts. It is not possible as a whole.

Ontario) is the "biological motion" study of Dr. Gunnar Johansson (1973) (See Figure 9). In this study two people are dressed in black body suits, with large reflective squares placed at their joints on top of the suit. The squares are positioned at the major joints on the body and the two participants are asked to move around. The scene is completely black with the exception of a black light shining on the participants which illuminates the reflective squares. It is the general response of viewers that at first the only things you see are the squares moving in some unusual pattern. It usually takes 30-60 seconds before you see the squares as part of human movement, and your mind fills in the rest, including body shape and gender. This is a popular example of very precise guessing and an example of the sensitivity our minds possess to map recognizable shapes.

My interpretation was slightly different and confirmed again how easily we can be fooled. These illusions delay cognitive reason, and this is the basis of my hypothesis. If in these more obscure situations of visual impairedness, we make mistakes or at least our ability to decipher form is insufficient, how can we honestly describe anything as true? How many conditions must exist before our understanding is compromised? What are the visual elements that are important for us to understand what we see? As much as the square test suggest we can be fooled by our eyes it also demonstrates the importance of motion in our ability to at least recognize human form, and at most recognize gender.

One of the benefits to animation is that the jury may look at it a number of times and at different angles to better understand how the incident took place. This may reduce the inability to map obscure images, yet may not eliminate it. I discussed the efficiency of mapping and discarding information in motion perception. We assume the position, motion and speed of objects based on the images over time, then with experience we are more efficient and discard information which is familiar. How do we base our judgment on visual imagery which may inadvertently fool us, or on information we may have discarded due to our experience. Police often report eyewitness accounts as weak. Such a belief is supported by psychological tests of eyewitness. Because of these same reasons, detailed descriptions from eyewitness are not reliable. Something more than relating the facts from evidence, to understanding the incident, to judgment is influencing the jury.

Emotions play a role

We are often mislead by seemingly logical conditions because of human factors which we hope would be outside the effect of thinking are not. A study done by Dr. Robert Sinclair at the University of Alberta described how environmental cues such as colour can affect our choice of problem solving strategies by the positive or negative signal perceived by the viewer.

Figure 9 Johanson's experiment in human motion
Screen capture and enhanced image

> ...cognitive tuning (choice of strategy to take) can be extended to situations involving external affective signals such as colour. Indeed, it appears that positive affective cues promote systematic processing. These cues can be environmental and can impact upon processing (Sinclair, Mark, pg. 70).

Sinclair takes this further in a following study to say our emotional state can affect our ability to make judgments. In his study he claimed the happier we are the less attentive to details we become in problem solving. Conversely, the more saddened or depressed we are the more likely we will examine issues more closely. Confidence, happiness, ego, apathy, contempt (internal sources), as well as environmental cues (external sources) made by jury members all influence judgments. If this occurs in a court room, jury members are tainted by mood influencing the strategies they enlist for decision making. This could be detrimental to those who are being accused and/or victimized. I am not suggesting that the people who sit on juries take their responsibilities lightly. On the contrary they may take them very seriously, knowing full well the responsibility they hold, but in turn it may boost their confidence due to a shift to a position of control. This may have a "positive" effect making them happy to be a part of something so important. Conversely, they may be emotionally stressed by the subject of the court proceedings. It would be in the interest of the public that the jury adopt the most systematic approach to their task whether they are influenced by either internal or external sources.

Conclusions about perception

Regarding perception, it is uncertain as to the exact neurological process which takes place in the brain. During visual perception an explanation as to the type of process which is taking place by the participants alters our opinion toward their attentiveness to the film. If we imagine that information comes to us directly from the film, not mapped to the memory of past experience as a method of identification, memory recall would seem to be fragmented. Gibson does not deny the existence of memory but questions the demand of energy needed for comparison rather than direct cues which trigger memory recall. Detailed perception of form is less critical for locomotion and navigation and in this regard Gibson may be correct. More conscious viewing, such as trying to identify someone in a crowd or tasks using hand - eye coordination, requires at least some past experience to be drawn upon and applied. This would indicate dual modes of perception for varied tasks. Calling upon jury members to view a re-enactment evokes conscious viewing, building a narrative, evaluating images and assessing what best represents the experience of the viewer. The struggle for jurors to have control over their emotional stress is problematic. It is preferred that jurors think more like judges, but the emotional stress alters logical thought processes and creates emotionally based decisions. The jurors for this study indicated frustration about the possibility for making incorrect judgments. The differences in their descriptions of

the event can be attributed to the variation of the juror's experiences used to build the story and the mood of the person describing what happened. The number of varying opinions, and the detail to which they are described, reflect the number of variations in this study.

The Animation

Different types of animations are characterized by film genre such as re-enactment, docu-drama, or simulation dramatization. The animations in this study may be regarded as simulation because they are not strict scientific representations. Considerations such as the mood and motivation of the characters are evident in the way scenes are constructed. It is inevitable that my bias towards animation may appear and its effects will be made known to the viewer, but I have made every effort to separate my opinion about the event from the production. Assumptions of the characters' specific movements and expressions were made with every effort to represent the facts as accurately as information would allow.

Part of my thesis will be to develop recommendations for data collection that can include elements missing from this investigation, and also to determine which elements have the potential to be more or less influential on juries opinion formed by the animation.

Literary review of film, animation and audience

It was important to assess the type of audience I would be asking to evaluate the films used in the study so that potential biases would be uncovered. Some of this information came from the surveys, but I also needed to clearly define the profile of all the participants including their social perspectives, their exposure to animated film, and find their level of sophistication with regard to film making techniques.

Canadians are exposed to animation produced mostly by the American film industry. The most recent are the creations of the computer generated variety. Even the grandfather of all animation producers, Walt Disney, uses computers more than in the past to create the classic style of animation which now can be generated faster adding to an already prolific image bank. It is a style which has been developed for the last 75 years, and now, with aid of computers, there is better colour, more sophisticated characters and greater appearance of depth to the scenes. Could this experience of animators not only create a realistic image but an experience which acts as surrogate for the real world?

Based on informal conversations and my own intuition and experiences as a viewer, I found that we identify with animated characters as much as we do with real-life actors on the screen. The quality of performance is what makes the characters believable in both animated and non-animated types of film. If the animation is poorly crafted, the motion is not smooth, or the variation in drawing or colouring is too great, or not suitable for the style of animation, we become consciously aware that we are watching a film. This awareness interferes with the plot or character development and, if it is great enough, we judge the movie as poor and the plot unbelievable. Similarly, interference occurs in nonfiction films as

well. Often reverse motion of a spinning wheel is an indication to our subconscious that something is wrong with the reality. Joseph Anderson, a film theorist, states...

> Because motion pictures can be constructed of the stuff of everyday experience, they can function as a surrogate for the physical world, not in the way that arbitrary symbols such as words may stand for physical objects, but as an actual substitute for the thing itself (Anderson, pg. 164).

Anderson is speaking of film using real actors and locations. The question is can animation be a substitute for the "stuff" that he is speaking of? Gibson describes "surrogate" as information: not propaganda to "mediate perception" and not arousing of an action. Gibson goes on to describe propaganda and arousal as "secondary surrogates", motivations which come from the film (Gibson. 1967). It is obvious that film had the potential to engage the viewer and relate to him or her as a surrogate for reality. This is important to note: within the context of legal proceedings we must also assess the potential of reason and responsibility to justice.

Film process and production

The computers themselves contributed to the particular aesthetic of the films, which, due to the constraints of the project, could not be fully explored in creating something unique. The physical features of the more realistic films were based on the police photos but tended to be stock constructions and not something I developed myself. Still, because of the flexibility of the software, I was able to create descriptive characters and mold them into likenesses of the people they portray.

As an exercise in understanding the creation of animated film, I chose a number of animations to watch frame by frame. *Gerry's Game:* Miramax films*; Ants:* Industrial Light and Magic*; A Bugs Life:* Disney Productions. This method was useful in looking at the speed and distances things move through virtual space. The longer it takes for something to move, the more frames are needed to create the slow motion, but by viewing animation frame by frame you start to recognize the detail which is added to the object to enhance the feeling of slowness. The feet of Gerry in *Gerry's Game* for instance tend to lag behind and straighten out at a slower rate than for someone walking at a moderate speed. It is these details which give the characters dimension and, in that sense, a more realistic quality. I also found that creating a sense of depth by changing the rates of speed to foreground, middleground, and background objects as they pass across the screen, is effective in creating a sense of perspective. This is done automatically in three -dimensional animation because you create objects in virtual space. The things closest to the camera's point of view move faster across the screen than those things farther away.

Pixar Films (an animation company in California) has numerous processors linked in parallel to produce feature length films. It will still take more power than this to develop animations in three-dimensions which are realistic as real-world film. The advantage over real-world film in terms of visual clarity is that the virtual space is infinitely more clear. Within traditional film making, the focal length of the camera lens causes a blur of distant objects outside the lens range. The computer renders objects in the distance with the same amount of detail as the objects in the foreground. When our eye moves to focus on objects of the real world, they are instantly in focus even at a distance. It may be this phenomena which indicates to us that this is not the cultural understanding of film reality nor reality itself but something else. A phenomenon which, with improved technique and extended use, will become a part of our understanding of our visual world -both real and virtual. As three-dimensional animation continues to become a part of our culture and technological advances produce a more realistic product animation will become a surrogate to the real world just as real world film does today.

Emotions through character development

The characters which I have rendered for this study are the result of my own personal bias. It can be said that other animators would create these characters differently, none of which would be a true representation of the actual characters. It is, however, an attempt to bring a more real representation closer to viewers to see if it is a worthwhile pursuit. Animation as a controllable form of demonstration is a robust medium, in which it is easy to simulate reality in a systematic way.

I interviewed many directors of film and theatre in order to understand approaches to character development for my animated films. It was difficult to employ some of the discussed techniques, because of the duration of the animation. Since I am a novice at film making I was aware that I could inadvertently overplay an emotional response or gesture which could have negative implications on my audience. However, I do feel it is an important aspect of the problem which could be a part of future study. A question actors ask of their characters is "What is my motivation?" This helps them describe the objectives of the moment or more specifically "what is it that I want?" Objectives, and tactics for achieving the objectives, are the cornerstones of developing character. It is also used by the viewer to construct a complete narrative as discussed earlier by Hastie.

> ...jurors impose a narrative story organization on trial information such as... generic expectations about what makes a complete story (e.g. knowledge that human actions are usually motivated by goals). (Hastie, pg. 194)

The tactics vary based on whether or not the objective has been achieved. The variation of tactics and

the number which are employed before the character succeeds or is diverted lends to the plausibility of the character. They may be diverted by outside influences, circumstances, or a change in objective and then a new objective is immediately adopted. The same occurs in animation, but objectives and tactics are of course applied to the character. The character representing an actual person cannot, therefore, attempt to reproduce the thought processes and assumptions which must be introduced. This, to some, may seem like a downfall to the process of recreating "real-life" scenarios, but if we are to operate within the given system that is judged by your peers we must allow for reasonable doubt to take place. If we were to allow animation to achieve absolute reality it would then become indisputable even when it might re-enact the event in a bias way. We must also keep in mind that the animations are based on forensic data, eyewitness and police reporting and these too are fallible.

Verbal versus visual versus real

As indicated before, research among psychologists showed that visual information not only stayed in the short-term memory longer than verbal descriptions but also visuals gave more detailed information about the subject. Much of this research has been done with simple objects or descriptions of actions. If we consider the complexity of a murder case and then try to explain the objects involved, the environment it took place in, the people, their relationships to one another, and their motivation for their actions, we can see that a verbal description begins to fail just in terms of retaining the facts. We must also consider that these descriptions can often take days to convey and are done so months and sometimes years after a crime has been committed. A jury is told the facts not only by the judge and the lawyers representing both sides but also by eye witnesses, professional witnesses and character witnesses. The reliability of witnesses has also been shown to be weak at best (Delisle, 1993). With any mode of communication it is the fidelity of delivery which determines scope of perception and depth of cognition. How then can we make an honest guess about what happened or the guilt or innocence of a human being in this type of low fidelity system?

A better way to describe the facts is needed. Whether in model form or drawings or three-dimensional animation, the one thing that must be said about the reconstruction of a crime scene is that it brings together all the evidence in a context, allowing the viewer to focus on the people involved and to understand both victim and perpetrator. Quickly, you get a sense of what physically is possible and plausible, as well as what emotional catalysts could cause certain actions. For instance, there is substantial experience indicating that jurors prefer a video deposition to the reading of a written one. (Kornblum, 1975) The issue of image properties aiding understanding of information is referred to as fidelity. In Shannon's theory (1948) fidelity is measured by the quantity of information transmitted. Joseph Lippen (1995) describes information of vision as more than object, behaviour or images alone. The following two

corresponding properties are necessary for complete understanding. Image information such as texture, lighting and motion, and visibility, which is the sensitivity of the viewer to the image properties as properties of the objects, or fidelity. Abstraction of properties will stimulate creative variance in the interpretation of information. The higher fidelity, the more concrete the learning (Lippen, 1995). In order to narrow the interpretation of the scenario, representations closer to reality limit abstracted variance and misinterpretation.

Understanding the physical as a visual object

To get a sense of the location of the crime scene, a scale model was constructed of the farm house. From measurements given to me by the RCMP and aerial photographs, I drafted a floor plan to scale (see Fig.10) and drew in the surrounding area. Trees lined the drive and the boundary of the yard so I knew the victims must have seen the attacker from rooms which faced the driveway. Next, I built a model of the house so that I could understand the interior space and carport area where the victim was shot. (RCMP photos). These two steps would have been redundant for the more experienced investigator or animator because they were then repeated within the animated portion of the study. The scale drawing was imported as a map to work in the three-dimensional computer model. The physical model helped to understand proportion and to work out inconsistencies in the dimensioned diagrams which were produced by the police. The main benefit to the three-dimensional computer model was that it enabled me to walk through the space as though I were the shooter, the victim, and the trespasser. This gave a reference to the emotional state of mind of the persons involved which I will speak of later.

Physical object to computer model

Often technology is criticized for its ability to overwhelm and to not allow us to look at past or alternative methods of performing the same tasks. For instance, in addition to the methods I have suggested and used here, there are numerous methods to approach the same problem. Where aerial photos, dimensional drawings and models are valuable tools they still only demonstrate a portion of the physical world which we understand in its infinite detail in a fraction of a second when we view it live. The computer models in three-dimensional space combine all of these tools plus they have the benefit of adding texture, creating movable characters and adjustable lighting which adds to the quality of the image on the screen. It allows us to recreate the real world as closely as we can given the information collected by the police in an accurate fashion.

We must also consider the physics of objects and characters within the computer environment. Current technology is capable of restricting movement based on the laws of natural physics. There have been

concerns of misrepresentation of fact based on an inability to control the animated world to accurately portray things like gravity, action/reaction physics and material properties such as load limits and points of failure. It must be said that many of these calculations can be added to the animation so that the re-enactments are accurate within the laws of physics but are not the exact replication of the incident itself. That is to say that creating something exactly the same with every detail is nearly impossible. Given the evidence of a particular incident, what we can make is a recreation of that incident, which is the most plausible. Correct measurements were calculated in creating the animation to ensure accuracy, but some assumptions had to be made where information was unavailable. We must consider the human factor. It is the unpredictable or instinctual behaviour which varies from the physics of nature. Plausible outcomes and possible theories of what took place is the most we can hope for. The current legal system works under the same premises. Assumptions based on physical evidence and witnesses are assembled to convince juries. The animation makes the assumptions concrete. They contextualize the evidence and make the witness accounts tangible.

Video versus animation

There are many practical reasons for choosing animation over video. It is not possible to recreate dangerous vehicle accidents, or in this case a shooting, to demonstrate the series of events. People would obviously be injured in such scenarios. It is also difficult for even good actors or stunt people to fall realistically due to our self preservation instinct. These types of inconsistencies are cues to the viewer that it is a staged event, lowering the fidelity of transmission. The knowledge of non-realistic figures who are incapable of actual physical harm to the other characters in the animation distances us from the actual event. The animation acts as a filter in that we are removed from the gruesome details of the realistic image. What purpose would true reality bring to the decision making process of a jury? Many prosecution lawyers and advocates for tougher sentencing would argue that revealing the severity of a crime could be demonstrated, and then a penalty which is "truly" appropriate could be handed down. In the examples which I provide, it is obvious that the re-enactments are an animation and not realistic enough to fool any viewers into believing it is real. All indications from the developers of computer animation technology are that realism is the ultimate goal.

> The extension of field of view coupled with stereoscopic display produces a feeling that we cease from viewing a picture on a screen to start experiencing the sensation of being in a place. We shift from external user exercising rights to internal participant experiencing responsibilities... This sensation of being surrounded makes us forget about the virtuality of the world we are exploring. (Bricken, pg. 93)

Not only is a realistic image their ultimate goal but also much research has been done in the areas of sensory development so that animated characters will interact virtually with each other. Development continues so that characters can see and feel objects and texture in their virtual worlds. In addition to that, a set of parameters are given to the character to determine how it responds to the objects and textures to coincide with the personality traits presupposed by the character developer (Computer Animation Conference, Geneva, Switzerland, 1991).

For example, a psychological assessment is made of the accused. From that a profile of the animated character could be developed and given a set of parameters which match the accused. Now, given the evidence of a crime scene, let's imagine an object is thrown by an assailant at a victim. The object is hard, rough and heavy, thrown at a distance of 3 meters. As a result the character hesitates before continuing the attack. This hesitation might suggest remorse or at least an awareness of the action. A detail which could easily be overlooked as insignificant but telling as to the state of mind of the accused. What does this mean in the context of this problem? The focus of this thesis is to compare two levels of realism based on the three elements of animation: lighting, texture and motion. What would be the result of this study if in every way I could create a realistic re-enactment? The conscientious observer should be able to separate him/herself from the fact that it is a re-enactment. If this is true why not use real actors and substitute animated characters for the physically difficult portions?

Actors bring their personality to video which clouds the issue of motivation or emotional state through body language. Actor's may carry themselves differently than the people they are portraying. It may seem obvious that animated characters also portray characteristics which are inconsistent with the real character. I believe that animation at this level of performance, lacks the ability to emulate personality traits of a human in any convincing manner. Part of the reason we understand that animated characters are not real is that they lack the subtleties of movement, such as adjusting a shirt while walking. The elements of light, texture and movement, although related to personality, are physical changes. The subtleties which I am referring to define the personality. For example, it's not so much what a character wears but how they wear it. (Johanson, 1973).

Dr. Frank Pollock of the University of Glasgow wrote a paper dealing with the recognition of animated characters from point light displays (see Figure 3 same as Johanson) published in *Psychological Science*. Dr. Pollock was testing the effect of motion variations on our ability to recognize specific characters.

> Negative exaggerations (of motion) were worse recognized than the unaltered sequences and the positive exaggerations. (Pollock, pg. 13)

Pollock indicated that the viewers were not aware of the exaggerations applied to the motion. The viewers did, however, say that they based their decisions on the motion. The opposite effect was found on the positive exaggeration of the motion in that the viewers were better at recognizing the characters when the animation was sped up. This would suggest that learning is done in exaggerated time; not only do we see separate frames of the motion but we assemble these frames, discarding what we determine is unneeded information, and recalling this exaggerated motion as the description of the characters.

This would be an argument for resolution below "absolute realism" unless we could control those subtle movements to suit the personality of the character we are trying to portray.

The theory of film making

When a director embarks on a film project the basis for its creation comes from the story. The director interprets the dialogue in a way which supports a concept or an idea. The type of characters needed to tell the story and the way the cinematography is crafted are all deliberate in their intent. Because the story of a crime or accident scene is in a sense, "written" and the characters cast, the importance of the film shifts to the cinematic focus. There are five (1) rules of thumb as formalized by Munsterberg (1916) and developed by years of film history:

1) Every shot should advance the story line
2) Actors should avoid broad gestures and avoid looking directly into the camera
3) Change camera angle, and size of image from one shot to the next
4) The camera should be kept on one side of the action (180 degree rule)
5) Tell story in action rather than words whenever possible

Many actors prepare themselves for a role by questioning the motivation of the character. Two objectives are questioned for every action; 1) What do I want? 2) How do I get it? This was useful as a guide for the creation of the characters when their actions are unknown. To simply state that the attacker arrived on the scene and went to the front door is insufficient. Yet it is unknown how he approached. Was his approach aggressive or secretive or curious. By asking the question of the attacker, "what do I want?", the answers come from one of two possible positions: the defence or the prosecution. The one most believable position, of course, is left to the jury to decide.

1. Munsterberg refers to a sixth rule that does not apply to animation. The crew members nor the equipment should never be seen by the audience.

Film as communication but not language

-the shot-

A communication is subject to context and cultural influence in order to be understood. There is semantic and syntactic coding in film, similar to linguistic structures. The "shot" is the smallest form of information which can be delivered and to which reference can be made. Similar to a word, the shot has semantic elements, for example, the parameters such as motion space and internal time (Worth, 1968). Motion space is defined as how the environment moves relative to us because of our movement from walking on a boat or riding in a car, including depth of space. Internal time is defined as the speed which is relative to us in relation to what we understand as "reasonable" time or movement of things to occur. The shot is developed into the story, the scene, and the intended meaning of the film within a syntactic structure. Using narrative or sequential organization we can make sense of the images in the sequence. Not only the organization but also the sequence itself has a meaning which we understand because of our familiarity with, and experience of, film viewing (Worth 1968). This is where the similarity ends because of two things: a) In order to follow this line of thinking what makes up the shot or the images, like the alphabet in language, must have specific symbolic meaning. No matter how the letter "A" looks in all the variety of fonts which are available, the immediate understanding of the letter is universal to English speakers. The image is not, since it is bound by cultural nuance and contextual variance; b) The other point which makes the film unlike language is grammar.

> "...that we can distinguish between what is a grammatical sequence and what is a non-grammatical sequence... it is almost impossible at this point to construct a sequence of shots that an audience will say is ungrammatical" (Worth pg. 27)

We are unable to distinguish between the grammatical and ungrammatical structures because of our tendency to connect a shot of events to another shot of an event. Imagine a shot of a B52 bomber flying in the sky and releasing a bomb. The next shot is of a burning hut. We automatically infer that the bomber hit the house and it burst into flames. This willingness to believe that the shots are connected is economical and allows us to experience film as narrative. The speed at which we connect the images and derive meaning from them allows the story to be fluid. Less information needs to be attached to the story in order for us to make connections similar to the process of viewing and discarding information which we do not need or are familiar with. The film again acts as surrogate to reality and does the work for the viewer. Rather than show the movement from one point to another the film maker uses two shots and splices them together. This is called a "cut." Just like the B52 and the house we make the connection from one shot to the next.

Editing through motion

-the cut-

Typically, motion is interrupted by "cuts" in a movie. At first thought, these seem unnatural to the method of seeing relative to the real world and would cause a disruption of the film. Comparatively, it is different from the way we see, for example, if we see an object like a car in front of us and then turn our head to the right to see a tree. We see the ground move below us and the indications of the background also follow our path of vision until we rest at the tree. In film a cut is often used to change the point of view (POV) which we still understand to be turning even though the transition from one object to the next is absent because indications in the background have similarity. Scale, and coloration of the image also give us clues that these are related images. Our mind make connections naturally in order to logically assemble the stimulus of the eye. In both Helmholz's (1920) theory of inference, and Gibson's (1967) theory of locomotion directive the order of images is critical in our ability to make sense of the world. As we pass by an object or turn our head we understand that the objects leave our field of vision but keep on existing. The continuity of existence leads us to believe the objects are still available to be seen again by reversing the motion. This is reinforced as true in our minds by the confirmation of the belief. We are not allotted this luxury in film viewing, but our minds tend to be occupied by the story and we assume the continuity of existence persists in film just as it does in real life.

Anderson (1996) defines three different types of cuts to categorize symbolic aspects of film which parallel cognitive processes.

1) simple cuts
2) orientation (relationship) cuts - points of view (POV), over the shoulder (OTS)
3) large scale relationship cuts - flash back, flash forward, (cross cutting)

The first is the simple cut which we described earlier of the car and the tree to the right. A simple cut which does not give a reason for changing point of view is called a jump cut. That is to say, where frames of the film are lost or the point at which the film is cut contrasts to the first frame of the next shot. If the change of the two shots is only in scale or colour or some other single attribute it jumps. It is sudden. To avoid jump cuts, filmmakers have by trial and error developed these three axioms for cutting shots together, the first of which has been mentioned as the simple cut.

1) The orientation cut is two shots of the same event and should change in POV and scale. Consistencies in coloration and lighting will aid in the transition from one shot to the next.
2) The transition cut transports the viewer across time as in a dream sequence or reference to

the past or future. The shots are remembrances symbolic of human thought. It is the transition itself which is important for example, using fades or transparent effects.

3) The cross cut shows the viewer two different events possibly occurring at the same time. Across town or in another room where there is some relationship between the two events.

(Anderson, 1996)

The difficulty with the orientation cuts has been mentioned previously in *the psychology of motion perception.* Orientation cuts can be very dynamic and are often used for emphasis on character mood. The orientation takes away the role of the viewer as observer and puts him or her in the action. It is for this reason the orientation cut is not used in the re-enactments. The cross cut and the transition cut are also not used in the re-enactments, because the events unfold in a linear fashion. There is however, a short overlap between cuts during the incident, but lasts less than one second.

These conventions of film are familiar to most movie goers so much so that we do not take note of their existence. They deviate from our real world view but still make sense for the narrative to continue. Conventions which are specific to film are also used in animation. Crafting animation frame by frame allows the animator to exaggerate movement and because of its comedic history, conventions for animation have also developed.

Final discussion on editing through motion

There are many more traditional forms of animation methods which include cell, clay and sand. It is clear that animators rely heavily on exaggeration to show mood through movement because they deal mainly with comedic subject matter, exaggeration emphasizes the hilarity of the sequence and gags being performed. Something even as simple as walking always seems to have some embellished twist added. The mechanics are similar to human motion and are good references to becoming a good animator in the traditional sense. Imitating animation of this type helped to understand character development.

Viewing physical fitness instructional video seemed to be more useful in the earlier stages of my study. They demonstrated a full range of body motion, including more natural ways of walking, running, and picking up objects. It is the job of the animator to allow the viewer to concentrate on the character itself and not on the motion as a separate consideration. It is important to understand the mechanics of motion and also how we alter the performance of motion in a personal way. A sequence of motions describes our character by the subtleties of performing the task. The order in which we assemble the sequence, the subtlety we include, our physical structure all describe the way we walk and demonstrate a portion of who we are. I will discuss the mechanics of motion later in the thesis.

Relationship to space

Film is different from reality because of the context of the medium. The film projected onto a flat screen, the border around the images, and the existence of seats and people next to us in the movie house are all cues to the method and place of viewing. Often we are so engrossed in a film that we lose ourselves to it, but we still do not get up to walk into the screen as if it were an entrance to a new world. What relationship then exists between the viewer of film and the screen that allows us to understand three dimensional space and, at the same time, not be fooled by it. We need a definition of depth perception within reality to see what conditions are the same on film.

Hugo Munsterberg makes a similar comparison describing depth perception with the following three axioms (Munsterberg, 1916):

1) The figure to ground relationship
2) View point of each eye as stereoscope
3) Distant motion relative to foreground has less detail

All of these axioms are a part of the film makers vocabulary and implemented in film. However, our visual system is always aware of the flatness of the screen and virtual space.

Relationship to time

The animation in this study is described as three-dimensional, but it is the forgotten dimension of time that is equally important and intriguing. Motion is the only element which I have chosen to have a time related component. Therefore, I will refer to the motion of the characters, but many examples could also apply to other elements and their references to time.

> "It took 20 seconds for the gunman to reach the bedroom and retrieve the gun from under the mattress, return to the front door and fire the first shot".

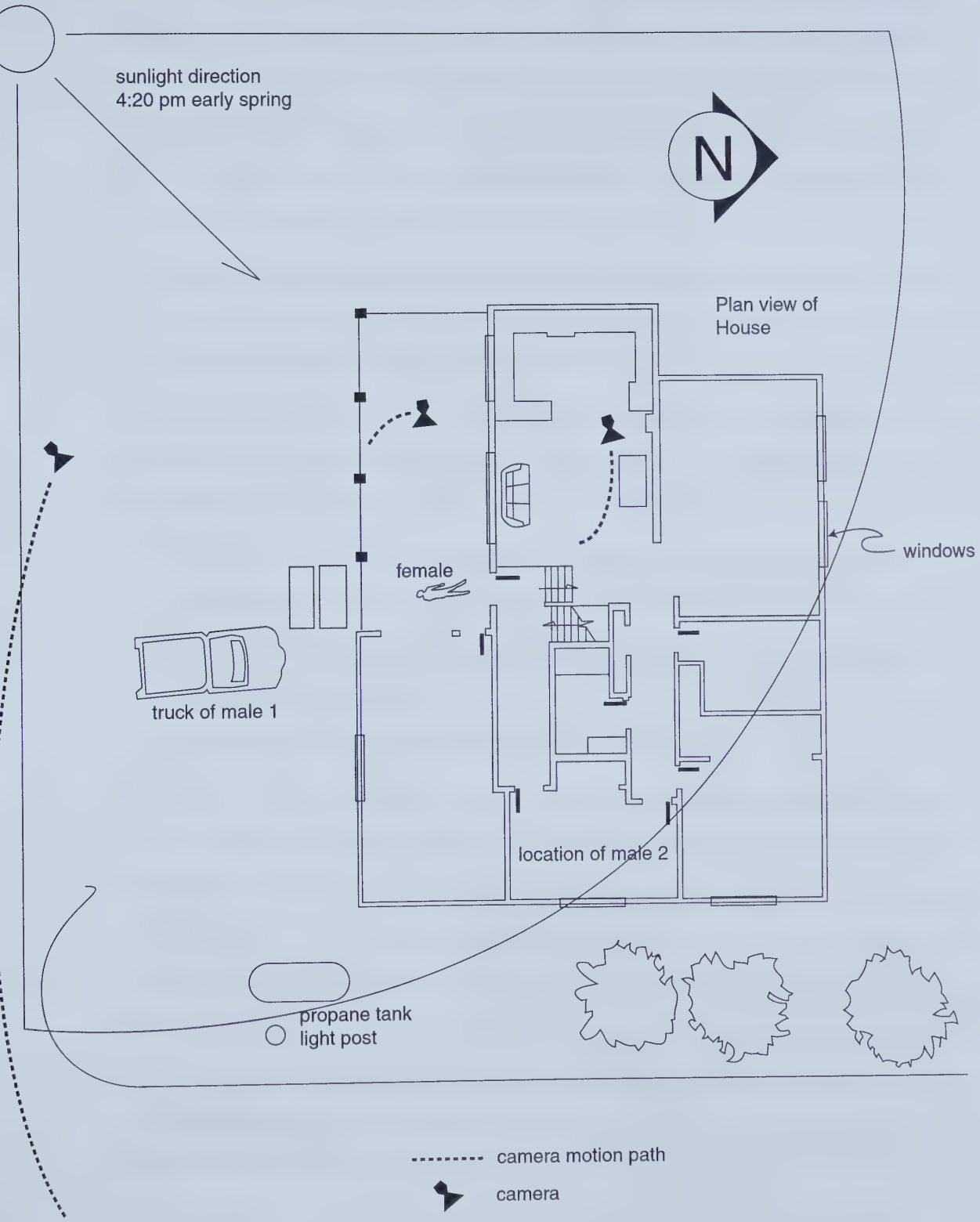
After reading this sentence does one have a real understanding of how long it took the gunman to get to the front door? Was he running, or walking, or crawling? It would depend on how far the bedroom was from where he was standing. If the bedroom was in close proximity 20 seconds may seem like a long time which would suggest that he walked or crawled. That also suggests that he was calm, allowing him to think about the actions he was taking; however the motivation for retrieving the gun may still be fear even if he was running or crawling, and the amount of time is still the same. It speaks more to the frame of mind that allows him to use the gun under certain circumstances. If he is running, he may be thinking of getting the gun and then getting to the front door, consequently firing when he sees he is being

attacked. If he is walking, he may be thinking of getting the gun and using it if he is attacked but hoping to display the gun and scare the attacker away. A floor plan was drawn to show the distance from the bedroom to where the first shot was fired. Assumptions could be made about where the gunman was in the house, but we still do not know how fast he had to move to act out the scenario. (Fig. 10)

To witness the motion over time I decided to have professional actors act out the scene. I measured out the floor plan of the house and situated the actors in different rooms so that I could time the various distances to the bedroom. Because the girl met the attacker under the car port, she must have seen the attacker drive up the driveway behind the house. If she heard a vehicle approach she must then have looked out a window to identify the vehicle approaching. She was a visitor to the farm, so it makes little sense for her alone to greet someone at the house.

There are three windows in the house from which one can see the driveway (see figure 10 for marked windows). I positioned the actors in these locations and video-taped the variations from different angles. I found this was more important than measuring the time it took the farmhand to go from the bedroom to the point of the first shot, because the attacker had not entered the house until the gunman had reached the point of the first shot. The attacker was first struck in the entry way of the front door. That meant the argument and scuffle outside lasted approximately the same time as the gunman took to retrieve the gun and fire. The distance down the hall took approximately the same time both walking and running (3-5 seconds). The argument had to have lasted at least 15 seconds, based on testimony of the gunman that, "they argued and then they started fighting." The attacker then threw her to the ground. All this proves is that the gunman had a minimum of 10 seconds to go and get the gun. Based on what was timed it showed that the gunman could have been anywhere on the main floor of the house. We know that it took at least 15 and as suggested earlier 20 seconds and maybe as much as 30 seconds for the gunman to even pick up the pistol. If you check your watch or count out this time it seems long enough to contemplate a defensive or aggressive action.

Figure 10


sunlight direction
4:20 pm early spring
N
Plan view of
House
windows
female
truck of male 1
location of male 2
propane tank
light post
camera motion path
camera

The Law

The findings of my study may be beneficial to Police, investigative personnel and others in the legal profession. As an investigative tool many of the same issues surface for both the RCMP and other police forces as they would for a jury: an overwillingness to allow the technology to persuade and a relaxing of the level of logical thinking. This acceptance without question is a problem which will be addressed. Also apparent, however, is the resistance to this type of technology in a court room by Canadian lawyers and judges who currently disallow juries to see animated simulations and declare them inadmissible. The intent of the law of evidence in Canada can be explained as follows:

> The rules of evidence control the presentation of facts before the court. Their purpose is to facilitate the introduction of logically relevant facts without sacrificing any fundamental policy of law which may be of more importance than the assertion of truth. (Sopinka as cited in Gardner, pg. 426)

For new science or technology evidence in the United States the assertion of "general acceptance" in the science community is reason for admissibility (Frye test). However, in the Canadian system we rely on the admissibility standard set out in the criminal code regarding new forms of evidence as follows:

> 1) The demonstrative evidence must be proven to be relevant to material issue in the case.
> 2) The witness providing the demonstrative evidence must identify it and testify that it is a fair and accurate representation of what it attempts to portray.
> 3) The witness must show that the evidence is not time consuming nor has a prejudicial value greater than its probative value.
> 4) Such evidence must not be cumulative. (Gardner, pg. 426)

It seems that it is easier to get animated re-enactments into the Canadian system because it is new and general acceptance in the science community is hard to evaluate. Canadian judges have used the American explanation to disallow re-enactments even though it does not conform to the formal rules of admissibility. Judges may be unfamiliar with animations' capability for clarification and understanding which could positively affect a case's outcome and expedite case proceedings. Ultimately, I am interested in the potential impact on the people who may be affected by the results. The victims of crime, the wrongfully accused, the jury and those involved in litigation should only be helped by this study. Animation and other computer technologies are being tried in an effort to give advantage to the legal system. Animation will only be useful if it is seen as impartial and non-affective. This same technology, which is now inadmissible, is also seen as inevitable in a court room. The future of animation should provide a better and easier case development tool which in turn should advance the understanding of animation

specific to its use in court. If understanding the implications of animation in a courtroom is important, then this thesis will prove to be a worthwhile endeavour.

Literary review on legal procedure

Finally, I examined the legal portion of the problem. History and precedent are the basis for the legal system. This means that acceptance of new technology and methods is met with resistance. Resistance is not unexpected due to the lack of existing research into the use of animation; however, one should attempt to understand it if it can improve current situations.

The closest ally to animation in demonstrative evidence is the photograph. Recently the governing bodies of some provincial courts announced that photographs may no longer be used as evidence in a court of law because of the ease with which an image can be manipulated. Computer technology which commonly exists can change a photograph with little trace that the image has been altered. Changing facial features, or objects in someone's possession became an issue of trust in the authenticity of the image. Animation, as simulation, never suggests that it is anything but a "simulation." The evidence is being depicted through the means of animation innately, giving it distance from the actual event: hence buffering the viewer from prejudice against the images because they are never meant to be real.

> Evidence which does not attempt to 'recreate' is admissible whereas the recreation of conditions which existed at the time of an event is inadmissible. (Clancy, pg. 208)

This has been the opinion of most legal professionals but there are indications which counter these arguments. In various forms the rules for admitting evidence such as film have not been relaxed, but films have found their way into the court room because of our growing familiarity with them as useful tools.

Live re-enactments by the defendant

R vs. Tookey
Edmonton Alberta, Canada
Hon. Justice J. Bracco Court of Queens Bench
In this murder trial the confession of Mr. Tookey was re-enacted at the crime scene by himself and admitted into evidence to explain his involvement. Mr. Tookey was aware of the video camera while acting out the scenario. It was important for the judge to see the original video tape in order to hear all the dialogue and movement of the defendant. Additional lighting was added prior to taping because of

poor visibility. Hearings of the tape were done during voir dire in order to determine admissibility, which were consequently included in the trial.

R vs. Lowery and King (No.3)
Sidney, Australia
Hon. Justice C. J. Winnecke
Admitted evidence of a video taped re-enactment of murder scene was by the defendant as part of a confession to the crime. The defendant was aware of the video taping and cognisant of its possible use against him in court. Although the judge was weary of the instructions told to him by the attending police officer about his re-enacting the crime, the judge was satisfied that the defendant was aware of his rights. (Goldstein, 1986)

> I think that basically the same procedure should be adopted as to the admission of evidence by one accused implicating the other whatever be the form the admission evidence takes, whether it be evidence of oral admission, or written admission, evidence of tape recordings or evidence of re-enactments. (C. J. Winnecke from Goldstein, 1986)

Winnecke assumes that all evidence is then received equally. Contrary to that is the direction of animation's evolution points to realistic qualities being produced daily. Some believe that this gives the advantage to those who have the latest technology. The legal establishment may be excessively cautious about this point, but they may also understand the future potential of animation and are safeguarding against the inevitable.

Many examples which I have found explain the benefits of animation and boast of how wonderfully they worked to persuade a jury or judge. One of the examples most often given as a source for investigation has been a case in Portland, Oregon (http://www.teleport.com/~police/ Portland Police (Appendix 2). The animation demonstrates the position and angle of the shooter to the police at a convenience store. It was the contentious report of the suspect that the police shot at him while he sat defenceless in his van, not able to get out or explain that he was not dangerous. According to the police forensic lab the bullet marks on the walls left by the shooter came from the same direction where the van was parked. Eye witness accounts corroborated the police investigation as to the location of the van. Using this technique helped to organize the supporting evidence, the story, and did help to confirm what actually happened as correct.

There is little doubt that the animations are effective in developing a whole understanding of the crime scene. Legally these are inadmissible because they are reported as not being the best available evidence.

This could be argued based on the cited examples of R vs. Tookey and R vs. Lowery and King. The confessions represented by the animations are an extension of the confession recorded on 911 transcripts.

The admissibility and the Criminal Code

According to the Criminal code of Canada, challenging of jury members is not easy. Unlike the American system, interviews with potential jury members are not allowed . The selection takes place with minimal information available to the prosecution and defence lawyers, and they must decide to challenge the juror for cause or peremptory based on minimal information given by each jury member. The following are grounds for which to do so and are the basis for the four restrictions of my focus group members.

1) The name of the juror does not appear on the panel, but no misnomer or misdescription is a ground for challenge where it appears to the court that the description given on the panel sufficiently designates the person referred to;
2) A juror is not indifferent between the Queen and the accused;
3) A juror has been convicted of an offence for which he/she was sentenced to death or a term of imprisonment exceeding twelve months;
4) A juror is an alien;
5) A juror, even with aid of technical, personal, interpretative or other support services provided to the juror under section 627, is physically unable to perform properly the duties of a juror; or
6) A juror does not speak the official language of Canada that is the language of the accused or the official language of Canada in which the accused can best give testimony (Official languages of Canada: French and English).

The second condition of a juror to be indifferent between the Queen and the accused is the most common ground to contest a juror. Prejudice, sexual crimes, and drug related crimes have been successfully used to contest jurors but only a few have been based on violence against women (Legal Aid Ontario Research Facility). The following are cases that have been successfully challenged.

Pheasants (1995), 47 C.R (4th) 47 Ontario Division. Challenge for cause was permitted in a case involving violence against women. The accused was charged with assaulting, threatening and unlawfully confining his former girlfriend. The potential jurors were allowed to be asked whether they might be prejudiced against the accused because he was a man, the complainant was a woman, and the charges involved violence. A question that asked whether the potential jurors had experience with violence against women was, however, held to be too personally intrusive and was not permitted. The court held that the materi-

als filed by the defence had established the existence of a high level of violence by men against women within the context of a relationship and supported a reasonable belief that the potential jurors might not be impartial with respect to this issue.

B.(S). (1996) 47C.R (4th) 56 Ontario Division. This case involved long term spousal abuse. The court permitted a question addressing potential impartiality due to views on domestic abuse, although other questions were disallowed as being overly broad and intrusive. The form of questioning ultimately approved by the court advised the potential jurors that they were not being asked about their views on domestic violence, but only whether their beliefs or attitudes would prevent them from being fair and impartial members of the jury. In allowing the accused application for challenge, the court relied in part on Pheasant, above (where challenge was permitted on the subject of violence against women)

During deliberation the jury must also contend with each other, bringing in another area of study which is beyond the scope of this thesis. It should be said that there are more powers asserting to change the opinion, mind and judgements of those who sit outside the majority. It has been my intention not to persuade the jury but to present the evidence so that a "likely" scenario could be constructed. The burden of judgment still lies with the jury.

Are we prejudiced toward visual imagery?

Building on the 'backcloth'

The structure of the backcloth set out in the introduction attends to the adjacencies which develop from the process of investigation to correlations of information which are now dependent. In complex system theory it is important to understand the flow between adjacencies so that the potential for change in one area can be anticipated in another (Flood, 1988). The first adjacency was described as cognitive affect relative to forensic data and visual perception to the jury.

Psychologists and judges alike react negatively toward technology, declaring that it is too prejudicial. The technology is new and it is often difficult to explain the limitations and capabilities to the lay-person. The act itself as it is played out on the screen can be explicit: therefore overly influencing the jury and not allowing them to think of how the scenario may be inaccurate. Before this study, I would have agreed that it is unlikely a jury could separate truth from the impressive display of the animation. For this reason it was decided to allow the sample jurors in this study to view only one of the scenarios and have them attempt to single out the variables which could be more or less influential. The survey questions asked to the sample jury were directed to a particular animation they were watching. If both sides of the argument were shown to the sample jury, the jury that viewed the animation with the more realistic elements would have had an unfair advantage

The position of jury member in a court of law, is intimidating, watching an event with which they are unfamiliar in both the content of litigation and the context in which they will find themselves: a social environment that is consistent in tone with a room full of strangers for the jurors watching the animation for the first time. The sample jurors for this study will also be in a setting which will simulate the formality of jury deliberation. These two factors alone can cause them to be more attentive and aware of details. I think this is a positive framework to hold the survey group tests for two reasons.

Firstly, this simulates a typical jury situation. Although there will be no interaction between the group members it will be consistent then with studies which include this variable. Despite common complaints of potential jury members, often the importance of jury duty adds interest to the lives of people and they express a feeling of excitement when they are called. If the attorneys had objections toward any potential juror who is not willing to serve may challenge the court based on that unwillingness which can be detrimental to the case (Tanovich, Paciocco, Shurka 1997).

Secondly, the animation is of a killing, which they understand took place, by someone whose fate they will determine. Although it is difficult to create an atmosphere of this type of importance, I believe the

nature of the discussion is of a serious tone and the participants are aware of the potential importance of the study.

The second adjacency links judgment relative to production elements and the jury to the content. The first relationship of judgment to production elements has yet to be answered. If the elements affect judgements, it will be important to distinguish the effects of the elements on comprehension and on perceived responsibility of the crime. There may be differences which are detectable by the jury but not influential in terms of decision making. This will become more evident in the study results.

The relationship between the jury and the content hinges on clarity of the information that is seen and how it aids the juror. Currently, the type of evidence which is allowed into the court room to describe events is perplexing. According to Clancy in *Litigation in Review* (1996),

> Demonstrations of experiments used merely to illustrate the principles informing an expert opinion do not require strict adherence to the facts. (Clancy, pg. 209)

Real life scenarios of this type, demonstrate evidence that would be of little help to the jury in arriving at the true description of what actually happened. The "expert opinion films" could be just as influential to the benefit of the defendant. If we are to understand the inherent influential ability of the visual image it serves both extremes. The banal is not neutrally exclusive. We must understand that all things visual have an impact even if it is small. The assumption should be that persuasion is present both for or against. Using the motorcycle example in the introduction, the audience may underestimate the severity of the injuries suffered by the rider, despite the intention of the demonstration to show the speed and angle of the motorcycle's path. It is possible for these to prejudice the jury either way. Animation has the same potential: we must be cautious in the production of both types of demonstrative evidence. Each hold to similar criteria for examination.

As a method of understanding the problem the content can be defined by extremes as difference poles. Position the problem between the extreme ends. It is a matter of developing a prenumbrial scale and finding where on the scale the question appropriately falls. If the gunman had come directly down the hall and killed the girl after shooting the attacker it would be an obvious case of murder. If on the other hand, while running down the hall, the gunman tripped on something which caused the gun to hit the floor and discharged, firing the bullet ricocheting off the railing, through the attacker and then killing the girl, most people would consider that an accidental death. The aggressive and self-defence scenarios in this case reside somewhere in the middle. To summon the complexity of the problem between two simplified extremes is not enough to justify a study. Therefore, included are as many difference poles as

were needed to create a field of oppositions.

Michael Twyman of Reading University in England spoke to the Art and Design department while I was working on this thesis. He employed a matrix to define specific works within the range of graphic to script along the top of the matrix and static to dynamic along the left hand side. It was a simple but effective tool for understanding current works, and all could be arranged within the matrix to examine the relationships one to another. I felt that it would be a useful tool to define complex problems if I added a third dimension. It was never the intent of this thesis to decide this case, nor am I offering a solution, but I am proposing that this case is typical of the kind of instance where animation can best be used. Animation helps to identify what Ray Jackendoff describes as the "non-ideal" difference pole which is opposite the range of graphics in Twyman's example which would be considered "ideal" because they can be defined. Without clear definitions of the difference pole and considering the concept's subject matter it becomes difficult for a judge to make a decisive choice.

> Such a position accords better with common sense, ...because it submits to the cognitive stress induced by non-ideal instances of a concept. (Jackendoff, pg. 201).

If both sides to the story are presented using animation, this model could be used to define the case visually. The comparison of two animations sets the field of opposition of multiple difference poles. The fidelity of the animation delivers an ideal instance, given the information is acceptable by both parties as possible scenarios. This leaves the viewer to position their judgment between the difference poles with reduced cognitive stress.

A visual age

Are we prepared for the future of animation?

In the opening statements of my thesis I alluded to the direction of future animation. Experiments at the Denmark University attempted to simulate variations of motion by assigning sensors to limbs of an animated figure. The sensors enable the limb to react specifically to varying surface materials. This is an exciting approach, but would require continued development of surface materials which in the world of animation is another area of study. The quality of three-dimensional environments illustrates volume and space better than traditional animation, but their quality of motion is still below what we have come to expect from film.

A conference is held every year in Geneva, Switzerland to discuss the future of animation and Avatar research.

> An Avatar is a virtual character created within a computer environment who possesses physical, sensory and simulated emotional qualities bound by the environment which simulates live forms either human or otherwise. (Thalman, pg.96)

The latest in the creation of Avatar is the tracking of vision receptors, tactile response mechanisms, and personality input sequencing. The industry is propelling virtually real Avatars so that man-made characters will be programmed with specified characteristics and "personality" traits. As the technologies become more efficient and implemented into one virtual character, we get closer to characters who operate dependent on virtual world input rather than human manipulation. If it is the intent of the computer industries involved in animation to duplicate humans and environments virtually, we can assume these simulated characters will find their way into areas where we currently find animation. If this study is any indication of the effect that animation may have on the public it should be made known to those who engage in the development of software.

The Study

Cohorts

My initial thoughts on the organization of the focus groups were 12 members to simulate a jury who would view two scenarios at different resolutions. One of the problems anticipated with these studies was that obvious comparisons lead participants to want to please the "instructor," not to select the scenario which best describes the event. The participants anticipate what would be a desirable response, which distorts the perception and the data. It was then decided to compare equal levels of resolution to the contrasting scenarios and measure the data across the groups. This allowed the sample size to stay small because the elements remain the same within each comparison. The focus groups was to be made up of a cross section of the general population. I asked the following of the candidates prior to their acceptance and agreement to participate in the study:

1) Are you between the ages of 18-65?
2) Have you seen any form of animation (movies, television, internet, video games) in the last year?
3) Have you ever been involved in a violent domestic dispute?
4) Do you have strong opinions about violence against women?

When comparing the realistic qualities; texture, light and motion to the effect of the animation on a jury it was important to determine which qualities have influence over judgement. In order to single out the specific effects of these realistic qualities, a low or what is termed here the "none state" (2) was the base level to which the three qualities were compared. This accounts for the crude features of the animations. It was also important that the narrative was clear to the participants because my intention was not to fool the participants with unclear facts about the case. Therefore, once the characters and the environments were built and the motion of the characters was developed, they would remain as a constant throughout all the films. Only a single quality was the exception to the films that followed:

N(none) A(motion) B(lighting) C(texture)

Statistically a study would consider each element as a binary variable; it exists or it does not. In order to determine the number of participants, multiply the variables and the number of participants within each group. Because I have three elements (motion, lighting, texture) and one non-existing condition (control,) a group size of 20 persons per variable, in this case I would need 160 participants.

2. This category defines the lack of emphasis placed on any of the three elements included in the other films.

The "none state" is the comparative value for all the other films; N versus A, N versus B, N versus C. To ensure a good sample size, 24 participants were tested for each comparison value, except for motion which had only 23 participants. Therefore a sample for N could be used to compare all other films, bringing the total to 95 people.

The Questionnaire

The results of the study proved the questionnaire to be clear, generally acceptable with participants having no difficulty with the instructions, wording or concepts involved. However, the scale needed to be explained where participants wished to use a no answer or were not able to answer based on the information provided. This difficulty arose in the first session of testing, and the participants in all the sessions were instructed to use the "4" value as unknown, indifferent, not applicable, or no answer. Often notes such as " I couldn't tell " or " I don't remember " were included on the questions when some participants had this difficulty.

The questionnaire was divided into six parts. Part one concerned the demographics of the group. Part two dealt with self-evaluation of animation knowledge, experience and expertise. Part three was the qualitative analysis of the participants understanding of the scenario and also gave important feedback on their initial perception. The remaining sections (parts four, five and six) were the quantifiable values given to the characters and the film itself. Part four specifically asked about the mood of the characters and their relationship with each other. Part five asked the participants to evaluate the film qualities. Part six dealt with the legal judgement with regard to responsibility and penalty. This final portion of the questionnaire also had a ballot component which asked the participants to cast a ballot and assign a penalty to whomever they felt was guilty. The penalties ranged from 1-3 years to 10 or more based on the definitions of the convictions read to them prior to viewing the films (see preamble to study).

The cohorts randomly viewed one of the four different films. Out of the 95 participants 49 were female and 46 were male ranging in age from 18-65. Twenty eight spoke English as a second language but none of the participants seemed to have difficulty with understanding the questionnaire. The education range varied between high school diploma and masters degree with greater numbers in the lower end of the scale.

Nearly all were familiar with the method of producing animation. Of those, 57 percent of the participants indicated a knowledge of three-dimensional animation saying they had seen one movie using this technology. Many of the participants indicated that the animation was poor quality and "more special effects" should have been added. Only two people were members of the legal profession, although

eighteen had been involved with the legal system, seven of which, approximately six percent, responded negatively to their experiences in the legal system.

Approximately 11 percent of the participants incorrectly described the scenario in the first question about the film. In discussions with some of these individuals after the study it was determined that the cut from the second to the third shot was problematic in determining who was Male One and who was Male Two. The first male leaves the woman in the car port to the left of the screen. Meanwhile, Male Two is approaching the front entry from a back bedroom, turns left and fires the gun at Male One. Because of the similarity in the appearance, the similarity in speed at which both men are moving and because Male One was obscured by the stair rail some people believed that Male One was shooting and Male Two was injured. Another explanation for this may also be due to our need for continuity of the story. Male One is seen throwing the female to the ground, and people can assume that he also must be the one attacking Male Two, the current boyfriend of the female (see appendix 5 for transcripts). Although 11 percent is a small number of participants it did show as oddities in some of the scales. Answers to the question of who was responsible for the death of the woman were clear indications, although not exclusively, of the persons who were incorrect in their understanding of the event.

A physical description of the characters was asked of the participants as another source to indicate the level of understanding of the information. Where this was generally answered poorly, those who were incorrect about the scenario gave little description of the characters or gave a description of the characters' mood instead of physical appearance. Conversely, some viewers described elaborate detail which was not at all present in the animations and is consistent with eyewitness studies which demonstrate unreliability.

In addition to the screening of participants they are asked to sign a participation agreement which states they are subjects of their own free will and understand the purpose of the study and their right to withdraw. No participants will be paid for their participation. Tests will last no longer than one and one-half hours.

Description of the study

For the purposes of this study preliminary testing will be used as a sample and conclusions will be drawn from the structure of the study of 95 persons polled. Additional people have answered the survey, but, because the control survey is essentially the same film for each non-state, only the initial non-state viewers were calculated and assumed to be the same for all non-state conditions. It should be stated that the effect of elements: lighting, texture, and motion from the animations on judgement occurred at the

p=0.05 level (3). Fisher's adjusted Least Significant Difference (LSD) test indicated significant differences in the mood of the characters, mood of the participants and levels of realism at this level but no other significant effects were found with any of the remaining interactions.

The group sizes ranged from 1-8 people viewing the same movie and all participants were given the same instructions. Most participants where unfamiliar with the hypothesis and many were debriefed after the survey was over. Some viewers indicated that they needed to see the film more than once. The emphasis of the study was to determine their actions based on an understanding of the film and not a test of memory. This is also consistent with what would happen in a courtroom therefore, a second viewing was available to all groups. It took the participants approximately 20-40 minutes to write the survey.

To read the following graphs note that they compare the number of jurors who applied a value to the action of the participant in the event. For instance, in figure 11, the film in the none condition 3 people gave a value of 1 when asked, "what was the mood of the second male?" (1 = Not angry, hostile, or aggressive, 7 = Very angry, hostile, or aggressive).

3. The (p) level is an indication of the possible mean variation in the numerical values. The .05 is very

small variation and indicates the tests accuracy.

Preamble to viewing

Hello, my name is Gerry Derksen, a graduate student from the University of Alberta. This study deals with animated re-enactments. The film you are about to see is about a murder which took place in northern Alberta in the early nineties. The time of year is early spring at approximately 4:20 in the afternoon. The scene involves three people, one female and two males. The first male, which I describe in the survey as the man in the truck, is the ex-boyfriend of the female. The second male, which I describe in the survey as man in the house, is the current boyfriend of the female. Prior to the incident the ex-boyfriend had made threatening phone calls to both the female and the current boyfriend, threatening to kill them. You will notice two green lines on the screen which represent the paths of the bullets. Two shots were fired. As a result the ex-boyfriend was injured and the female was killed.

You should also have a ballot form on your desk. Please fill the ballot based on the definitions I am about to give you. The penalties are:

A) Accidental death - An action which causes death, where no direct link to or any unforeseeable causes or events can be linked to inadvertent actions resulting in death.

B) Manslaughter - Accidental death resulting from careless, reckless or thoughtless actions resulting in death of another human being

C) Second degree murder - The act of homicide with intent to kill at the time of the incident, as in acts of passion or acts in the heat of the moment.

D) Premeditated murder - The act of homicide where pre-planned, preparation or the utterance of the intent to kill prior to the incident occurs.

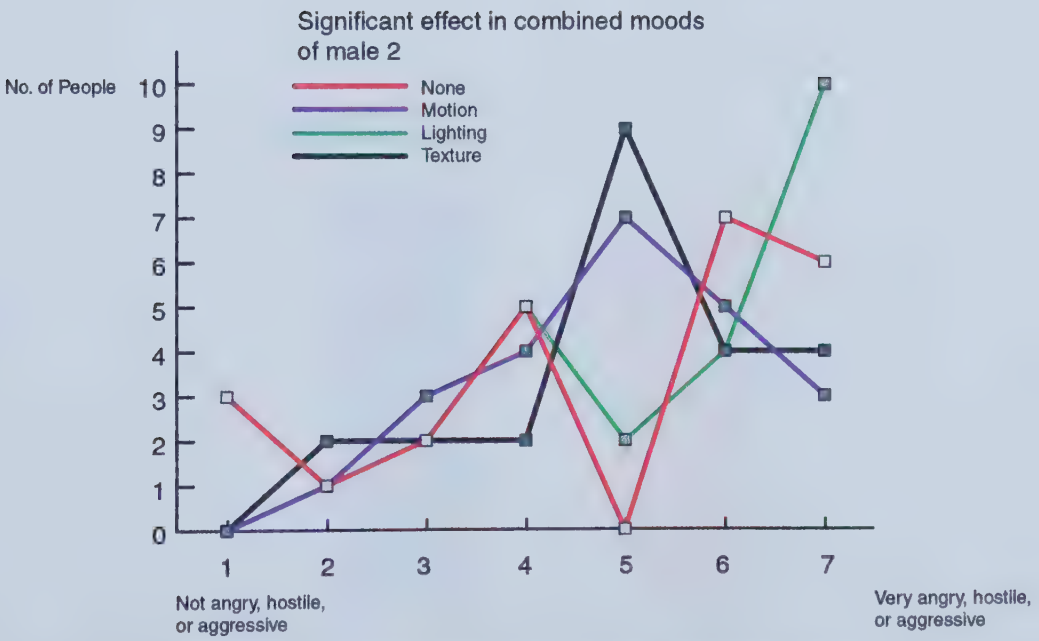
There are two sides to the pages in the survey. Once you are finished please place the survey in the envelope at the front and the ballot in the box. It is a short film so please watch closely and if you have any questions please ask. Thank you for your time.

Assessment of Character mood for Male 2 (man in the house)

Do you think the man in the house was angry, hostile,
and aggressive in his mood?

This graph shows the range of responses in the four films. It was determined that the mood question of the characters yielded the same result for anger, hostility and aggressive behavior.

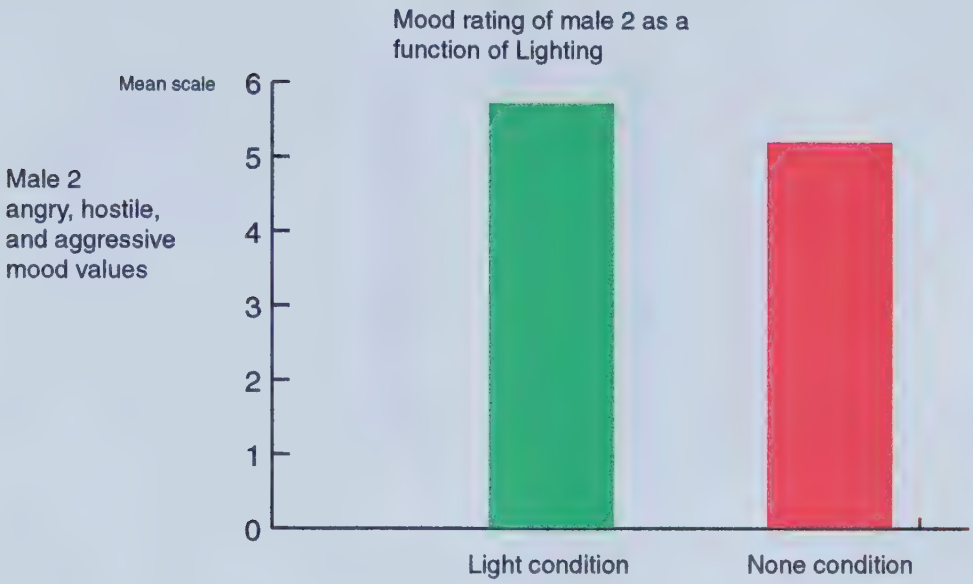
Figure 11



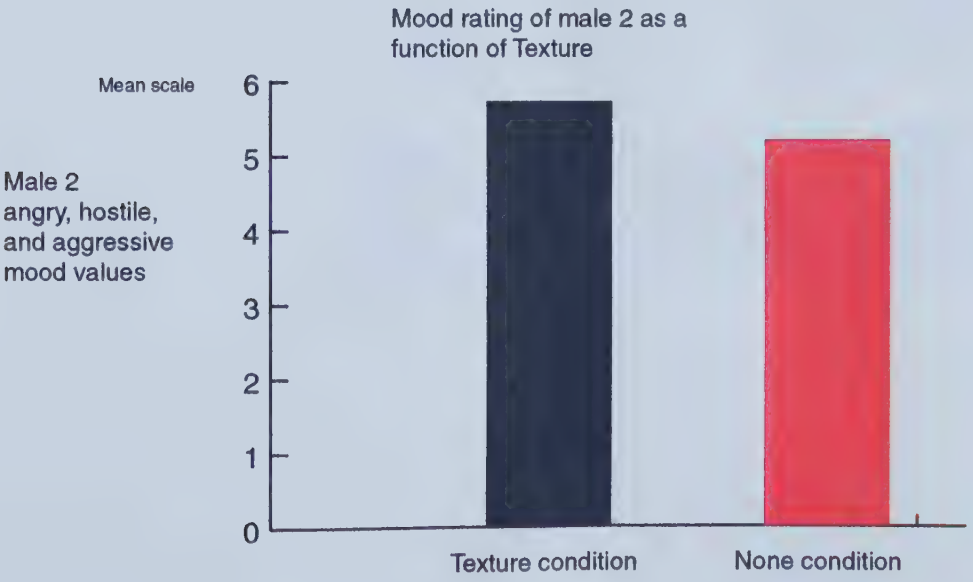
Lighting $F(1,94) = 6.08$, $p<.02$ mean variable of 5.74 in the positive condition and 5.22 in the negative condition
Texture $F(1,94) = 4.72$, $p<.04$ mean variable of 5.74 in the positive condition and 5.22 in the negative condition

This graph shows the mean value of all the responses of the films. For example, the Lighting animation mean value is 5.74 versus the none state animtion mean value is 5.22.

Fig. 12

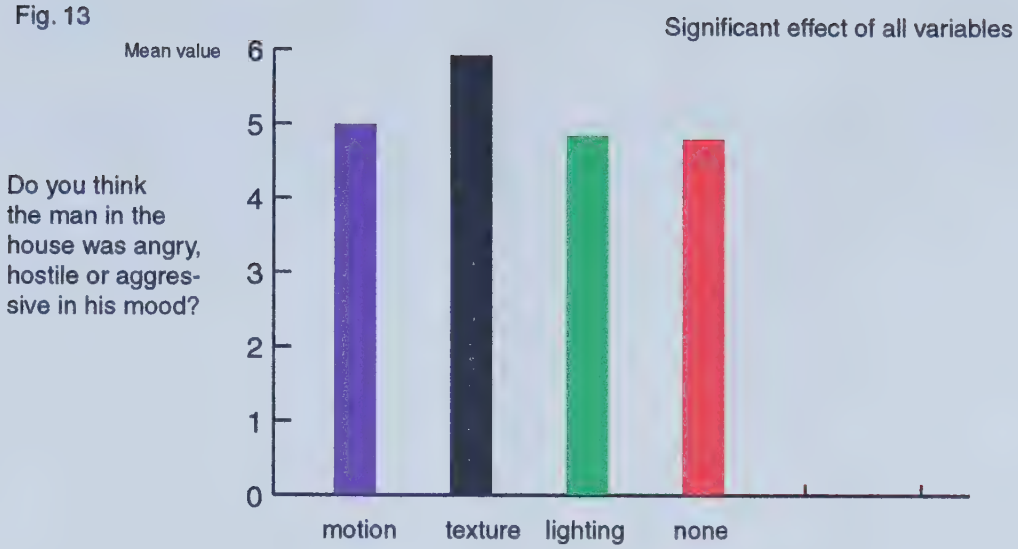


Lighting $F(1,94) = 6.08$, $p<.02$ mean variable of 5.74 in the positive condition and 5.22 in the negative condition



Texture $F(1,94) = 4.72$, $p<.04$ mean variable of 5.74 in the positive condition and 5.22 in the negative condition

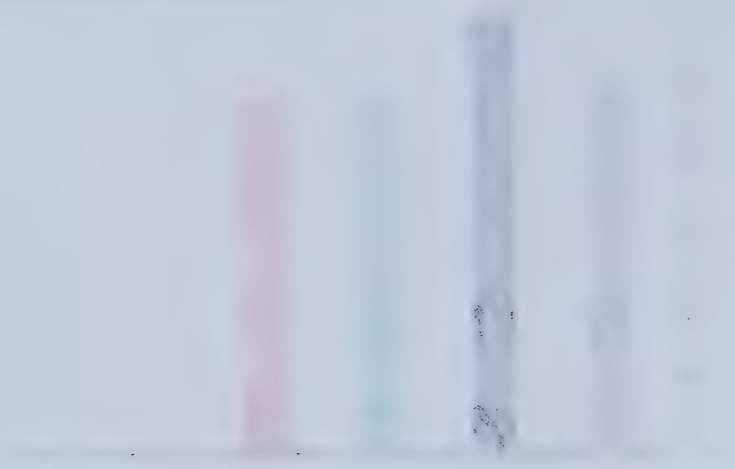
Fig. 13



F(3,94) = 3.00, p<.04 LSD test indicated that motion differs from lighting, texture differs from none, and lighting differs from none.

For perception of the mood of male 2 (man in the house) with regard to angry, hostile and aggressive mood type, the pattern of this interpretation is displayed in figure 11. As shown significant effect, $F(1,94) = 6.08$, $p < 0.02$, in the lighting animation ($m = 5.74$ and $m = 5.22$ for the positive and negative state respectively) there was also significant effect of the texture animation $F(1,94) = 4.72$, $p < 0.04$ ($m = 5.74$ and $m = 5.22$ for the positive and negative state respectively).

In the new variable of all four states (Fig. 13) relative to another there was significant effect $F(3,94) = 3.00$, $p < 0.04$ where motion differs from lighting ($m = 5.00$ and $m = 4.06$ for motion and lighting respectively). As well there was significant effect where texture differs from none and lighting differs from none. ($m = 5.97$, $m = 4.86$ and $m = 4.81$ for texture, lighting and none respectively). This may be due to increased fidelity in the lighting and texture states over the none state giving a clearer impression of the mood in male 2.

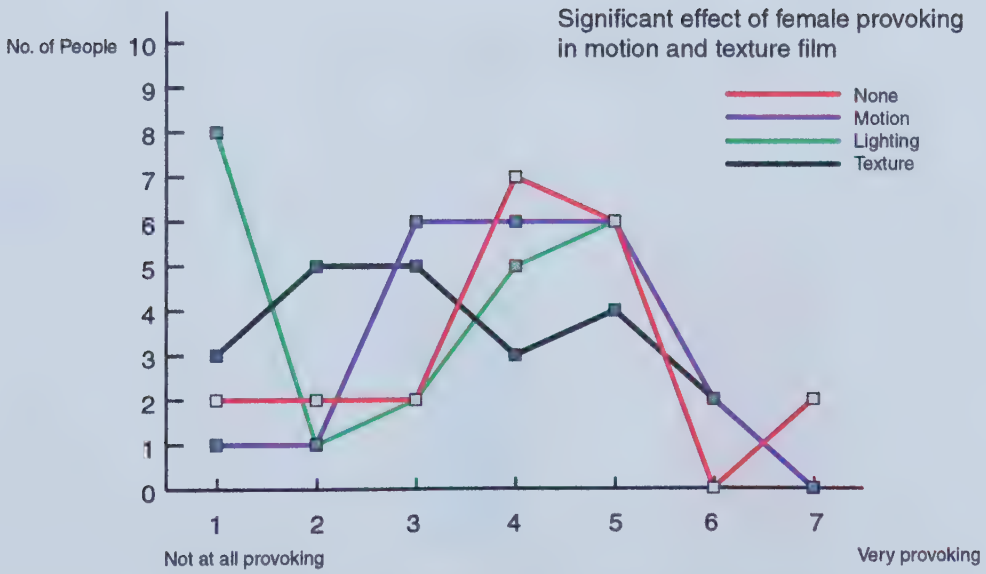


Assessment of Character mood for Female

Do you think the female was provocative?

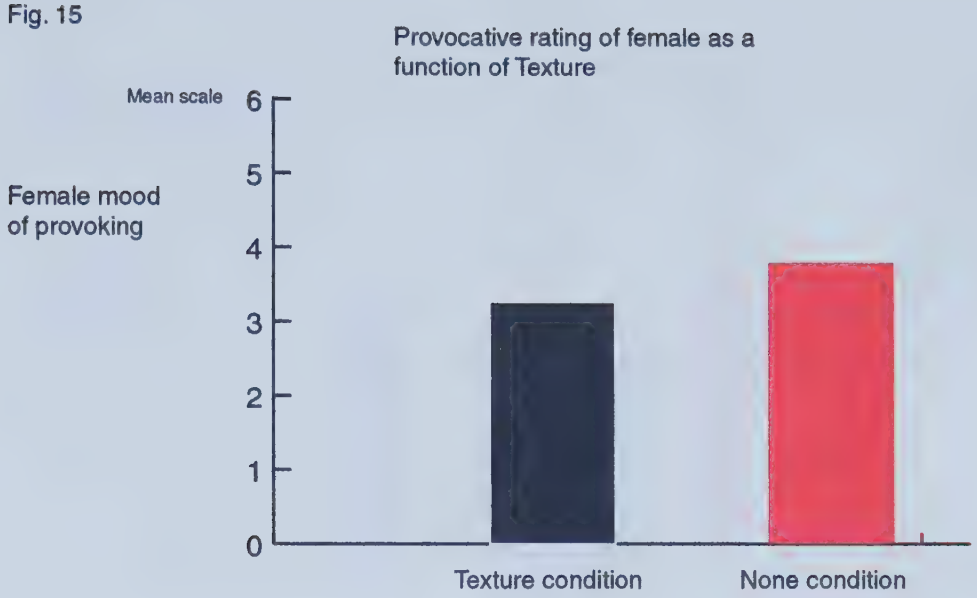
This graph shows the range of responses in the four films. Lighting and texture show that there is a decrease in the assessment of provocation. This may be due to varied colour of both texture and lighting films.

Figure 14

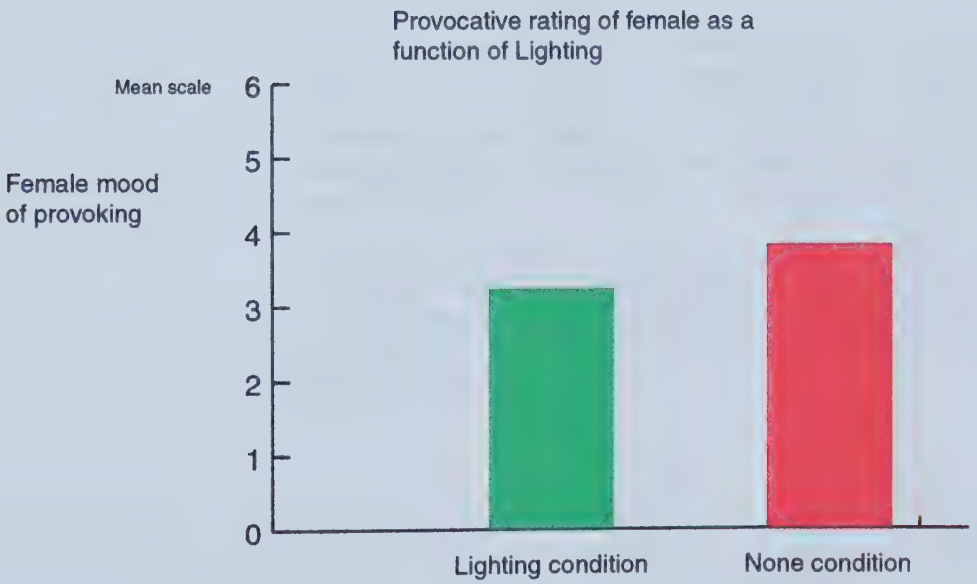


Lighting $F(1,88) = 4.67$, $p<.04$ mean variable of 3.25 in the positive condition and 3.84 in the negative condition
Texture $F(1,88) = 4.26$, $p<.05$ mean variable of 3.27 in the positive condition and 3.81in the negative condition

Fig. 15

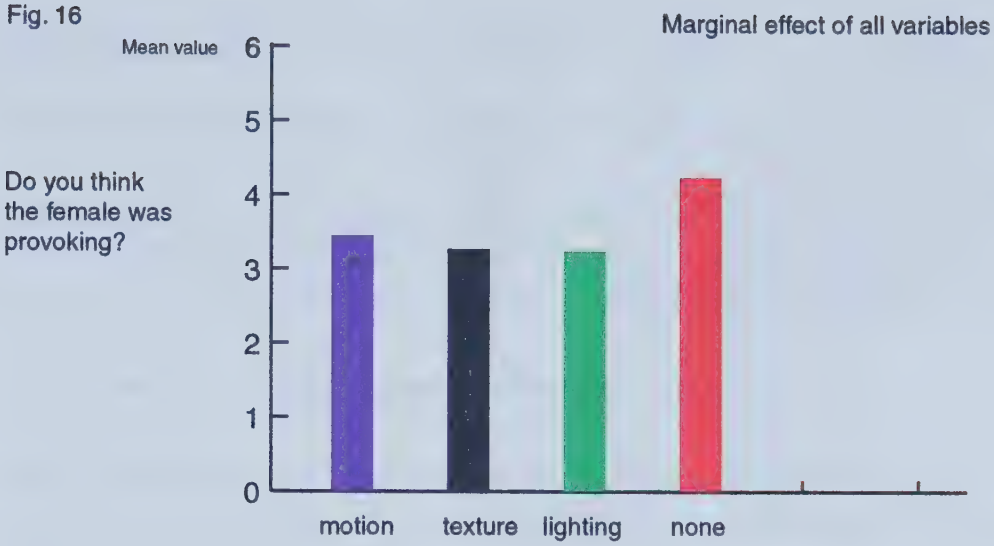


Texture $F(1,88) = 4.26$, $p<.05$ mean variable of 3.27 in the positive condition and 3.81in the negative condition



Lighting $F(1,88) = 4.67$, $p<.04$ mean variable of 3.25 in the positive condition and 3.84 in the negative condition

Fig. 16



F(3,88) = 2.27, p<.09 LSD test indicated that none differs from texture and none differs from lighting

Figure 15 illustrates the female's provoking mood in the lighting state $F(1,88) = 4.67$, $p < 0.04$ relative to the none state ($m = 3.25$ and $m = 3.84$ for the positive and negative state respectively) and similarly $F(1,88) = 4.26$, $p < 0.05$ of texture relative to the none state ($m = 3.27$ and $m = 3.81$ for the positive and negative state respectively) indicating the possible clarity of image in the positive states improves the perception of the mood which could be better defined.

In the variable test of all elements shown in figure 16 $F(3,88) = 2.27$, $p < 0.09$ there was marginal effect of lighting which differed from none ($m = 3.25$ and $m = 4.25$ for lighting and none states respectively). Similarly, there was marginal effect of texture which differed from none ($m = 3.27$ and $m = 4.25$ for texture and none states respectively).

Assessment of Character interaction (Figures 17a and 17b)

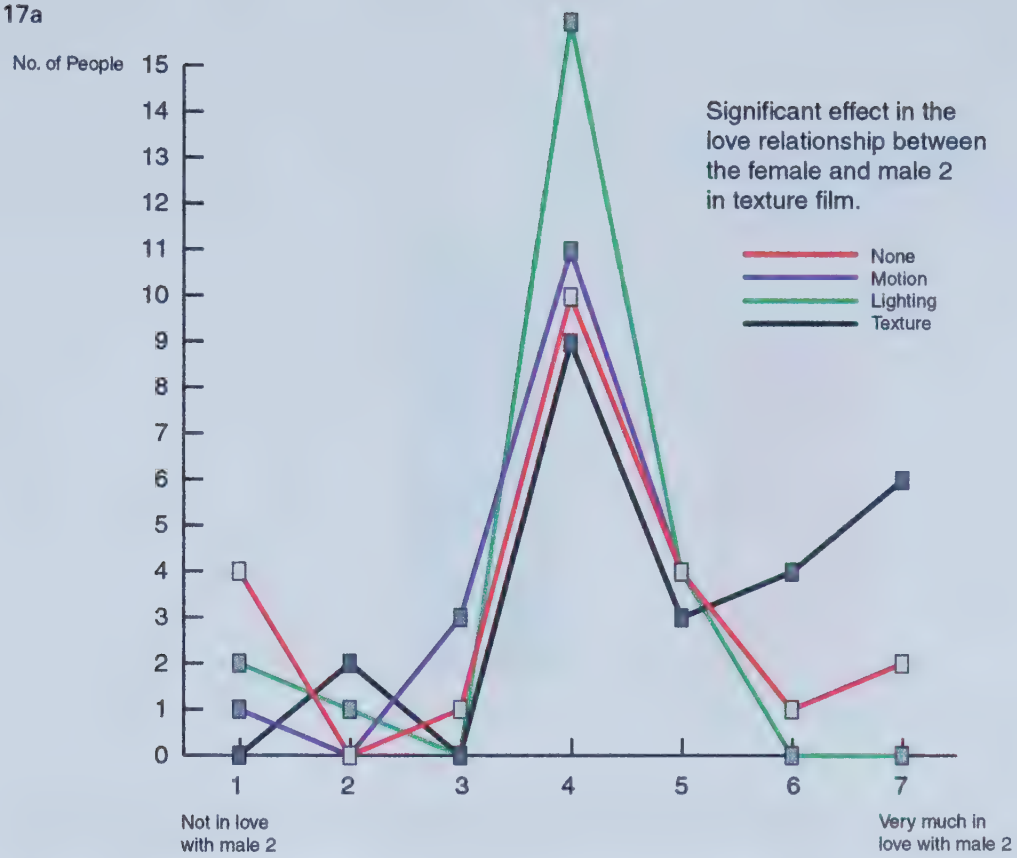
Do you think the female was in love with male 2 (man in the house)?

These two graphs show the range of responses in the four films which concern the interaction of the characters. Lighting in figure 17a shows there is an increase in the assessment of love. This may be due to the increase in unknown responses which are represented as the "#4" value.

Was the female responsible for male 1 actions (man in the truck)?

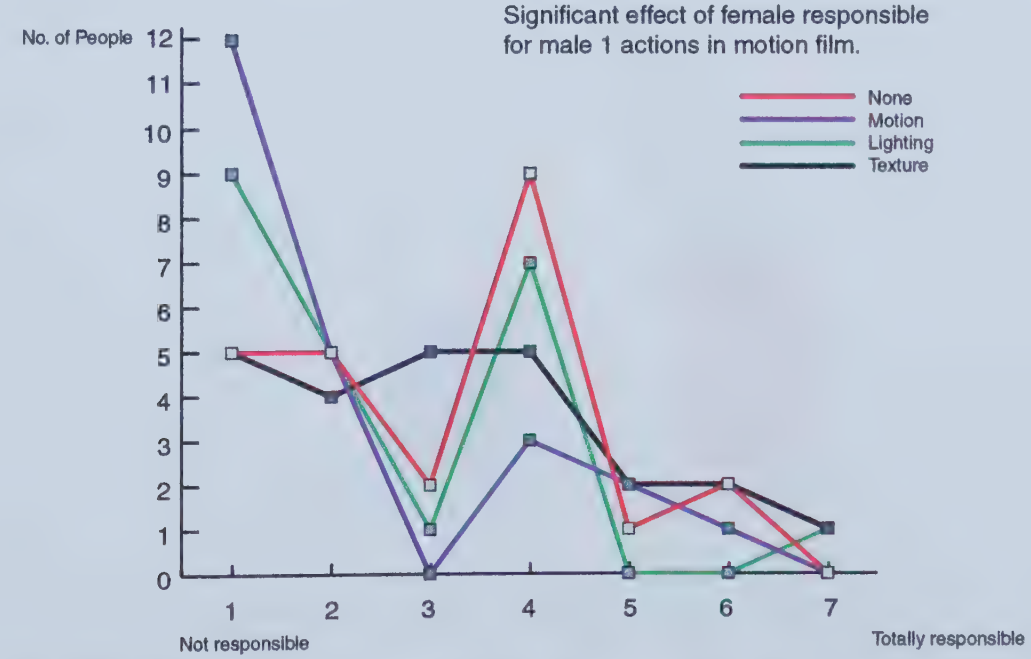
Similar to the reponses in figure 17a there is an increase in the unknown value "#4".
The difference in the remainder of the responses falls in the positive portion for figure 17a and the negative portion for figure 17b

Figure 17a



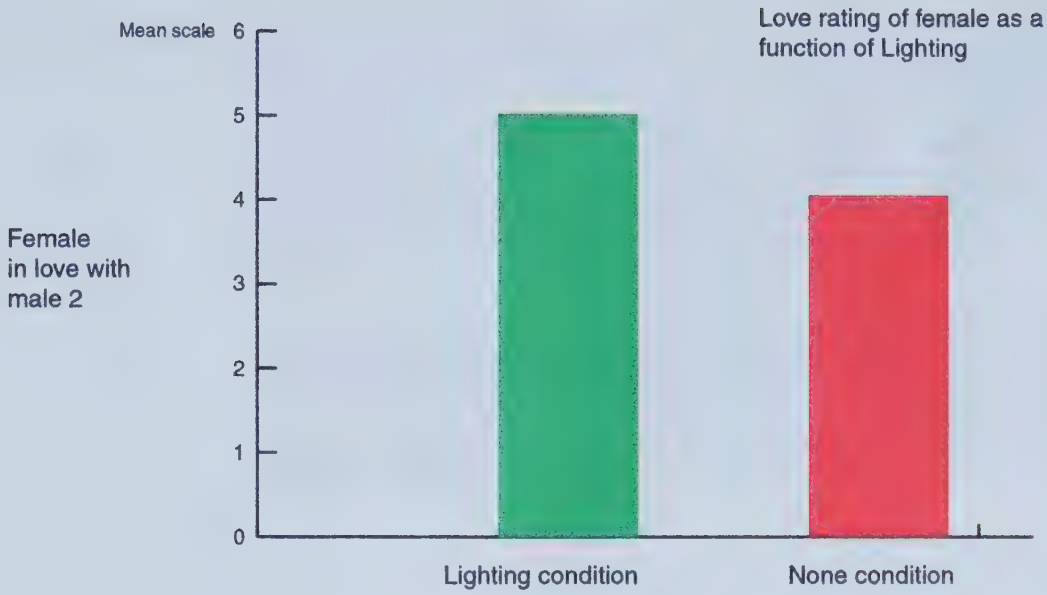
Lighting $F(1,89) = 4.79$, $p<.04$ mean variable of 5.04 in the positive condition and 4.07 in the negative condition

Figure 17b



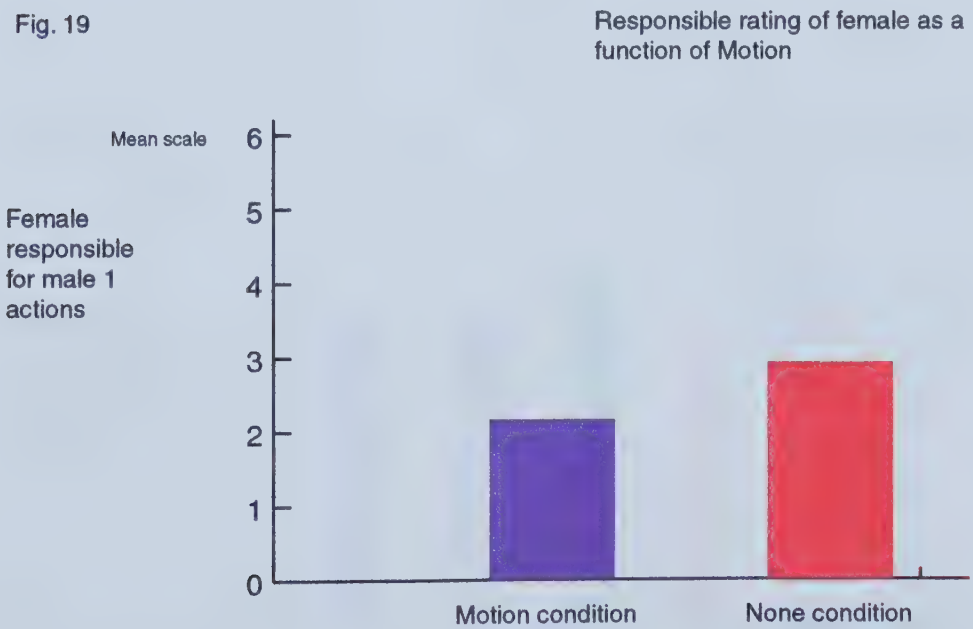
Motion $F(1,90) = 3.63$, $p<.06$ mean variable of 2.17 in the positive condition and 2.93 in the negative condition

Fig. 18



Lighting $F(1,89) = 4.79$, $p<.04$ mean variable of 5.04 in the positive condition and 4.07 in the negative condition

Fig. 19

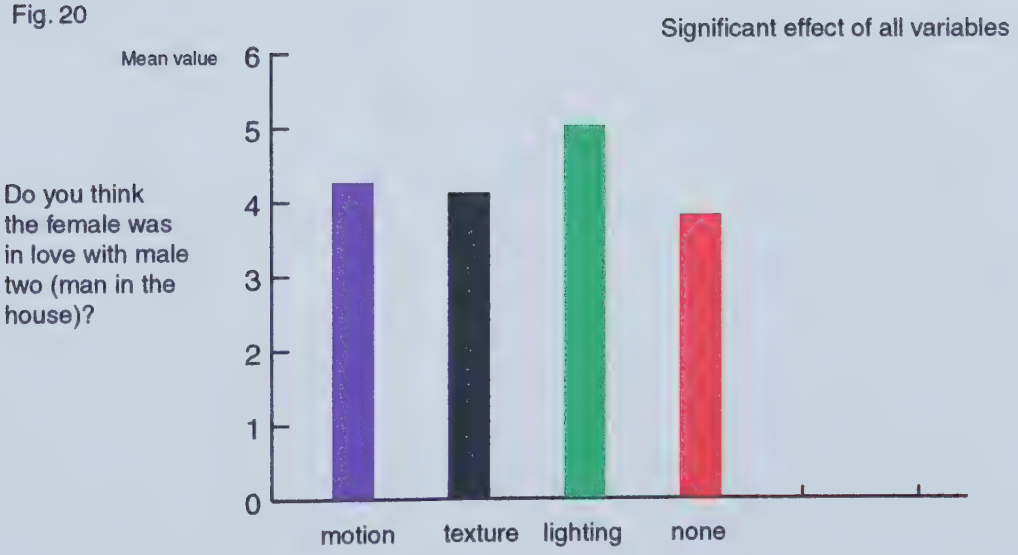


Motion $F(1,90) = 3.63$, $p<.06$ mean variable of 2.17 in the positive condition and 2.93 in the negative condition

In the relationship between the female and male 2 (man in the house) question her love for him in the lighting animation $F(1,89) = 4.79$, $p < 0.04$ relative to the none state ($m = 5.04$ and $m = 4.07$ for the positive and negative state respectively). It should be noted that significant interactions of the fourth value should be qualified by the indication of "unknown" or "could not tell" responses. There was significant effect in the relationship of the female and both males. The first deals with the female responsibility for male 1's (man in the truck) actions. In the motion animation $F(1,90) = 3.63$, $p < 0.06$ relative to the none state ($m = 2.17$ and $m = 2.93$ in the positive and negative state respectively). (Fig.18 -19).

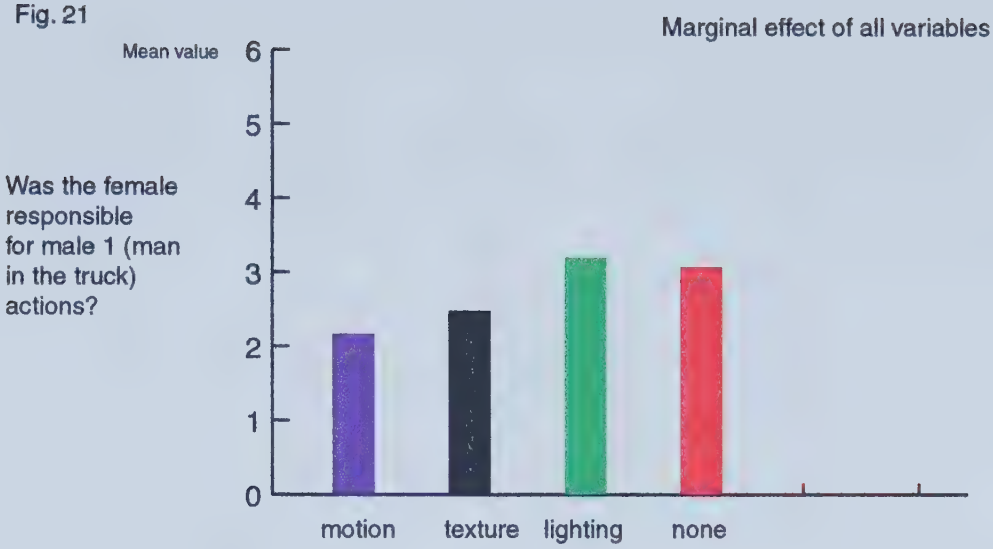
The significant effect of the female in love with male 2 (Fig. 20) in lighting differs from none and lighting differs from texture ($m = 5.04$, $m = 3.83$ and $m = 4.13$ for lighting, texture and none respectively). Where all variables are measured, shown in figure 21 the relationship of female responsible for male 1's actions $F(3,90) = 2.12$, $p < 0.11$ the marginal effect of motion differs from lighting ($m = 3.21$ and $m = 3.08$ for lighting and motion respectively).

Fig. 20



$F(3,89) = 3.02$, $p<.04$ LSD test indicated that lighting differs from texture and lighting differs from none.

Fig. 21



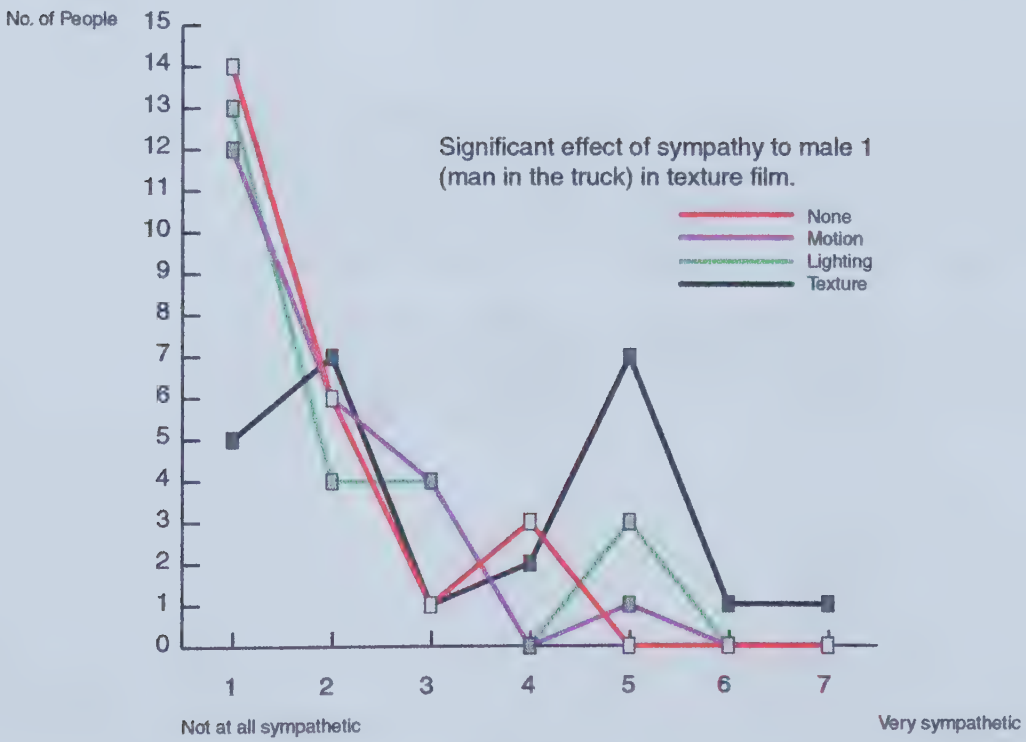
F(3,90) = 2.12, p<.11 LSD test indicated that motion differs from lighting

Assessment of Participants mood for Male 1 (man in the truck)

Were you sympathetic to male 1 (man in the truck)?

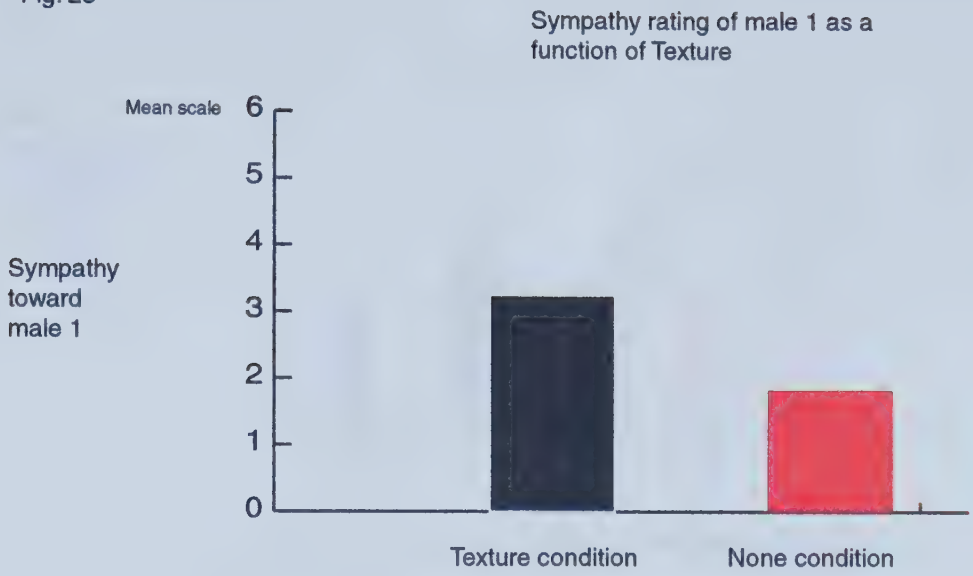
This graph shows the range of responses in the four films. This shows a very dramatic variation in mood of the participants in the texture film. All the other films have consistent result.

Figure 22



Texture $F(1,91) = 14.97$, $p<.0003$ mean variable of 3.25 in the positive condition and 1.83 in the negative condition

Fig. 23

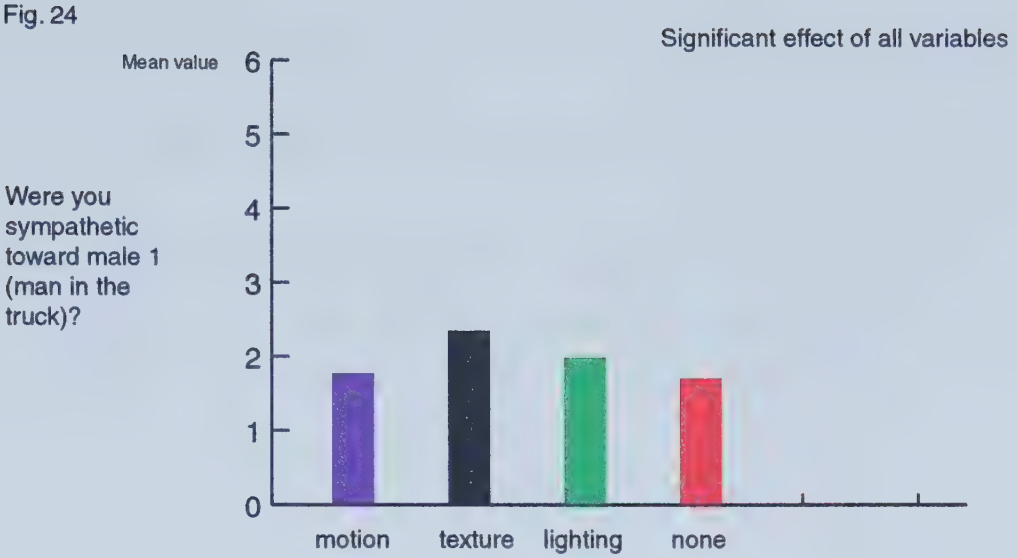


Texture F(1,91) = 14.97, p<.0003 mean variable of 3.25 in the positive condition and 1.83 in the negative condition

The only significant effect of covarient means occurs in the question of mood evaluation of the participant. Where sympathy for male 1 (man in the truck) in the texture animation $F(1,91) = 14.97$, $p < 0.0003$ relative to the none state ($m = 3.25$ and $m = 1.83$ for the positive and negative state respectively). This clearly shows a significant sympathetic view towards male 1 relative to the texture state. This may be due to a positive cue of the clothing colouration worn by male 1. (Fig. 23)

In the new variable test (Fig. 24) there was significant effect in the sympathy toward male 1 $F(3,91) = 6.51$, $p < 0.0006$ where texture differs from all other states ($m = 2.35$, $m = 2.00$, $m = 1.78$, and $m = 1.71$ for texture, lighting, motion and none states respectively).

Fig. 24



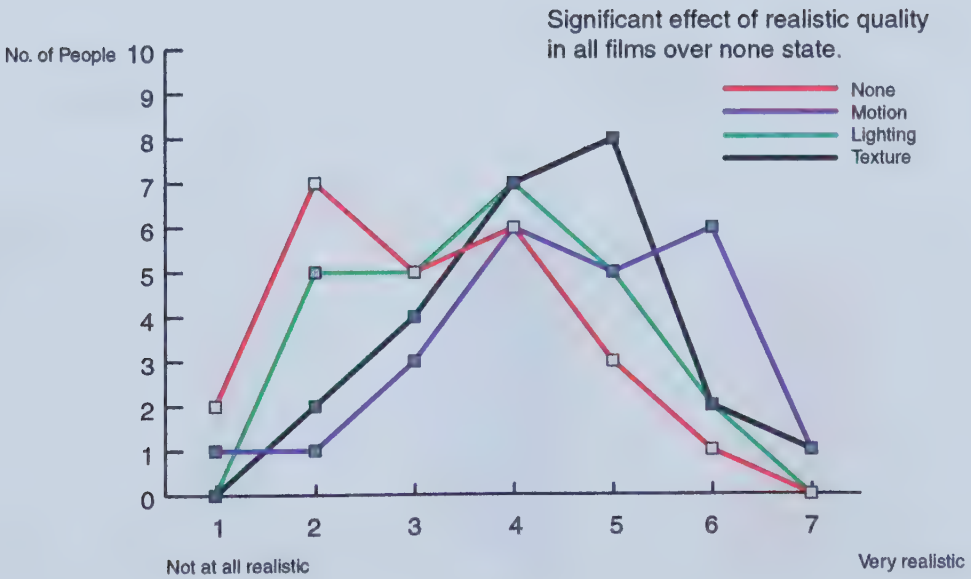
F(3,91) = 6.51, p<.0006 LSD test indicated that texture differs from lighting, texture differs from motion, and texture differs from none

Assessment of the Film

How realistic do you think the film was depicted?

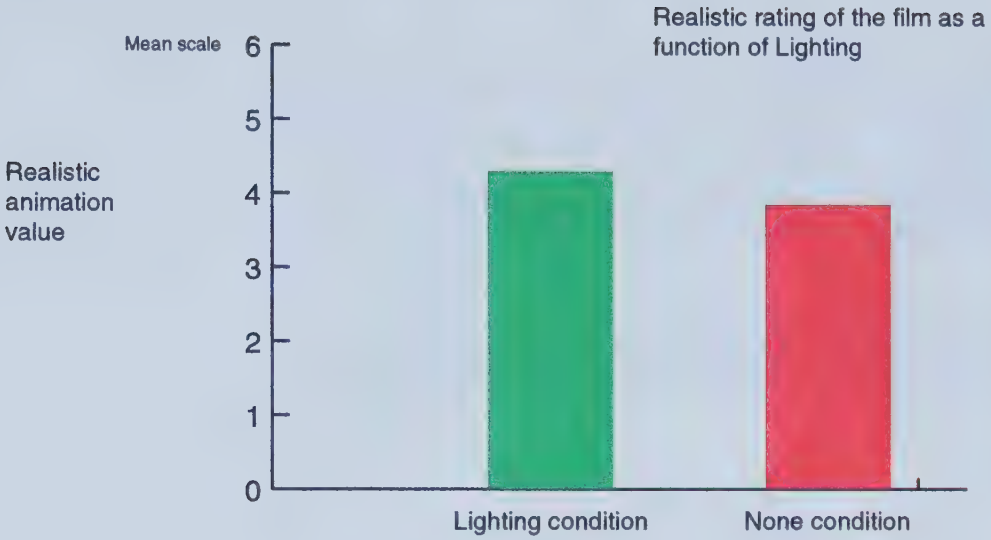
This graph shows the range of responses in the four films of all the questions regarding the realistic quality. It was determined that all the questions were similar in rating and therefore combined. It is clear that the films with the elements were rated more realistic.

Figure 25

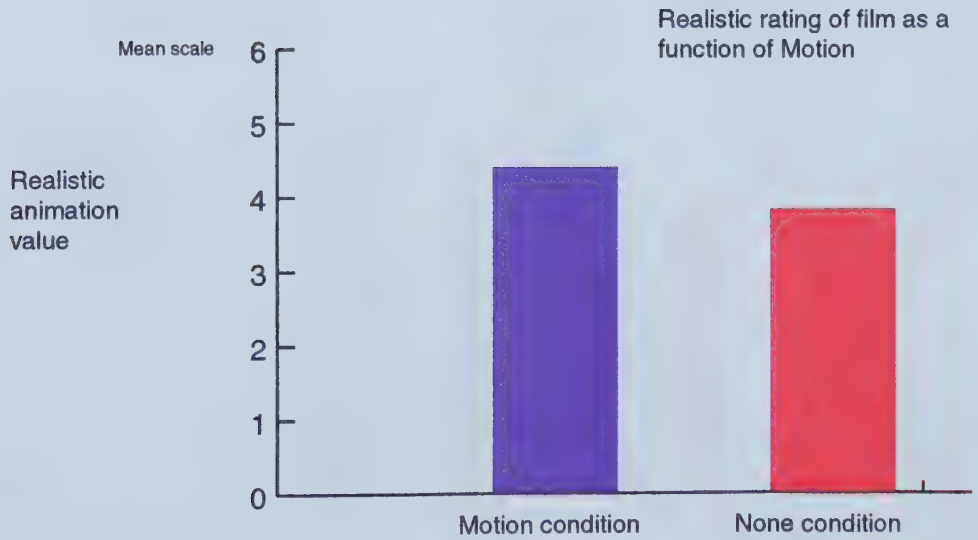


Motion $F(1,91) = 11.76$, $p<.001$ mean variable of 4.41 in the positive condition and 3.84 in the negative condition
Lighting $F(1,91) = 10.11$ $p<.003$ mean variable of 4.31 in the positive condition and 3.86 in the negative condition
Texture $F(1,91) = 3.58$, $p<.07$ mean variable of 3.90 in the positive condition and 4.0 in the negative condition

Fig. 26



Lighting $F(1,91) = 10.11$ $p<.003$ mean variable of 4.31 in the positive condition and 3.86 in the negative condition

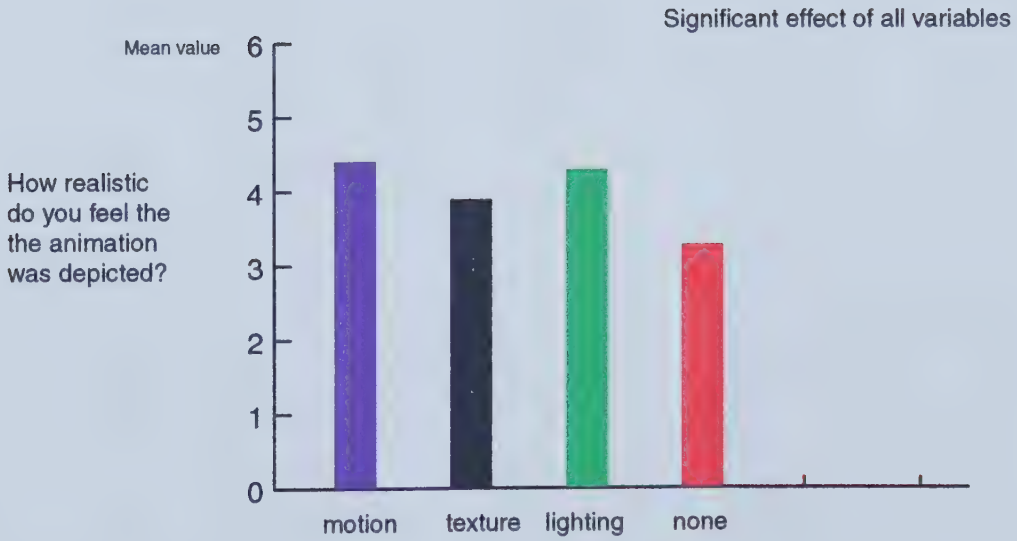


Motion $F(1,91) = 11.76$, $p<.001$ mean variable of 4.41 in the positive condition and 3.84 in the negative condition

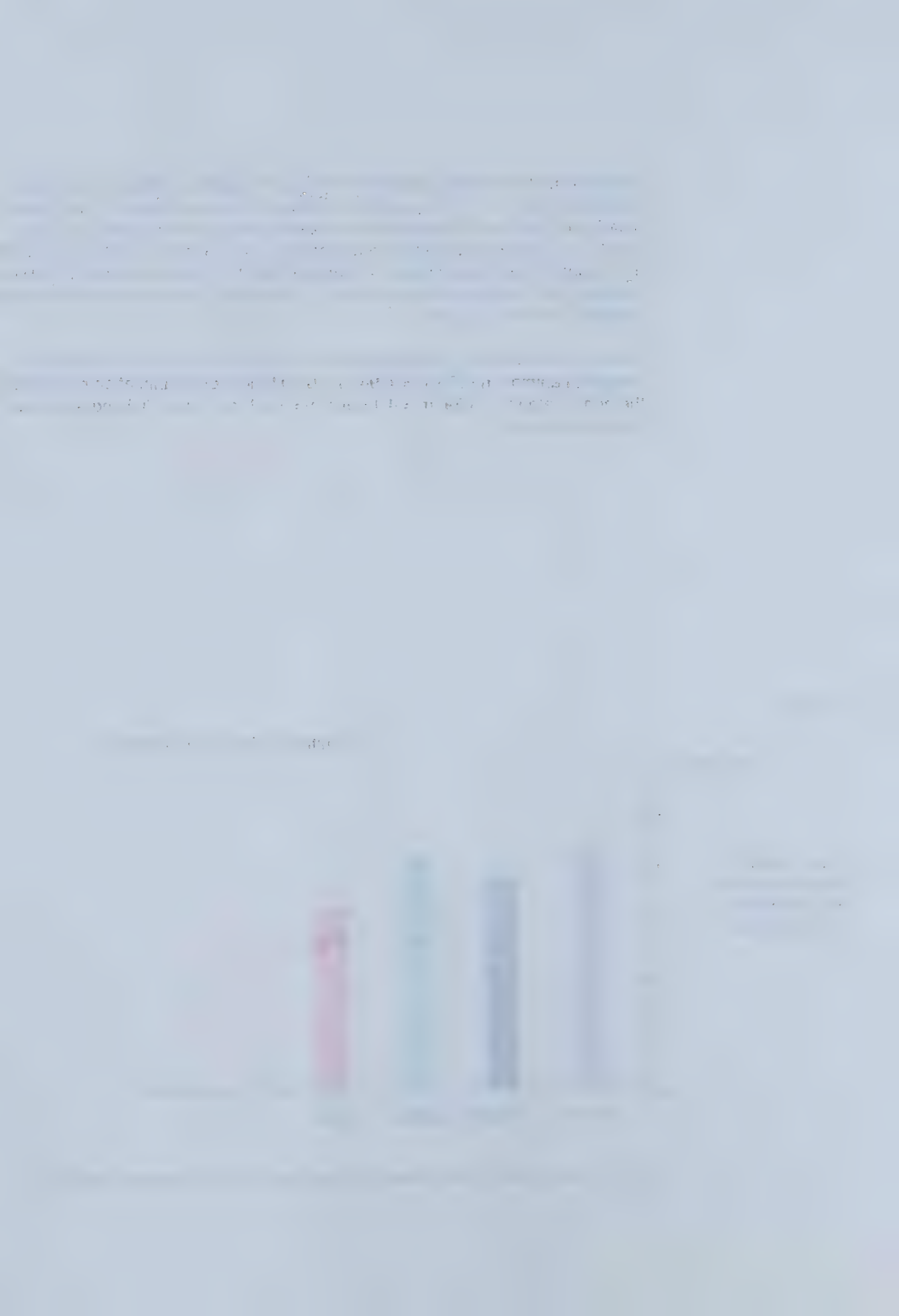
The pattern of interaction presented in figure 26 significant effect of realism in animation $F(1,91) = 11.76$, $p < 0.001$ relative to the none state ($m = 4.41$ and $m = 3.84$ for the positive and negative state respectively) as well lighting $F(1,91) = 10.11$, $p < 0.003$ relative to the none state ($m = 4.31$ and $m = 3.86$ for the positive and negative state respectively). A marginal effect of the texture state $F(1,91) = 3.58$, $p < 0.07$ relative to none state ($m = 3.90$ and $m = 4.00$ for the positive and negative state respectively).

Where all variables are measured shown in figure 27 the significant effect of realism in animation $F(3,91) = 4.94$, $p < 0.004$ the motion animation differs from the none state ($m = 3.29$, $m = 4.13$ and $m = 4.41$ for motion, lighting and none state respectively).

Fig. 27



$F(3,91) = 4.94$, $p<..004$ LSD test indicated that none differs from motion, none differs from lighting.



Visual setup of changing elements

Physical description of characters

See also Figure 34 of screen captures of film

General

Male 1 -	Approximately 5 feet 10 inches tall
	Short blond hair
	Heavy set (approx. 230 lbs.)
	Caucasian fair skin
Male 2 -	Approximately 6 feet tall
	Short brown hair
	Muscular build (approx. 190 lbs.)
	Caucasian fair skin
Female	Approximately 5 feet 7 inches tall
	Shoulder length hair
	Slight build (approx. 140 lbs.)
	Caucasian olive skin

Motion - The texture and materials used in the motion film are the same as the none state which are as follows:

Male 1 -	Short sleeve light green shirt
	Dark green pants
	Brown shoes
Male 2 -	Short sleeve light blue shirt
	Dark blue pants
	Black shoes
Female	Deep red T-shirt
	Dark green pants
	Brown shoes

Texture - The materials used in the texture film vary in colour and due to the pattern and highlights and shadows inherent in the texture map which is applied to the characters.

Male 1 -	Red and black jacket
	White shirt
	Faded blue jeans
	Brown shoes
Male 2 -	Striped medium blue shirt
	Dark blue jeans

Black shoes

Female Black T-shirt

Black jeans

Dark brown shoes

Lighting - The orange/yellow lighting which was added made the clothing and skin of the characters appear warmer. This was to simulate the sun's coloration.

Male 1 - Short sleeve light green shirt

Dark green pants

Brown shoes

Male 2 - Short sleeve light blue shirt

Dark blue pants

Black shoes

Female Deep red T-shirt

Dark green pants

Brown shoes

Physical description of the environment

General

A farm yard in northern Alberta with a tree-lined-drive with the entrance on the length of the house facing south. The house is a typical two bedroom split level house built in the early 1970s. A garage and carport are also attached to the south side of the home (see Figure 10)

Texture

The grass was irregular and browned in areas, the trees had more thorny branches as well as pine needles added. The house was clad in 8" siding and a stucco cement foundation which was typical of the period. The roof was also shingled and wood trim had a grain which resulted in variation of colour.

The interior was finished in a typical 70's style, with a gold vinyl flooring and off-white painted walls and ceiling. A wooden bannister on metal ballasts had a similar finish to the wooden trim of the doors and windows. The furniture was also textured with appropriate finishes of the time period.

Lighting and Motion

The materials in the environment were all flat colours of the general hue of the object. This was not always possible due to the intensity in these cases a more muted shade was chosen.

Figure 28

None state

Motion state

Lighting state

Texture state

Motion

Motion is an element that will change to create variations of "realism." Texture and lighting are the other two which I will discuss more in this chapter. It should be said that the choices of these elements are based on intuition for the most part but there are reasons to believe that my intuition may have some merit. I have studied motion prior to this thesis in a variety of ways. The most relevant is a project study to model an animated wire frame figure onto simplistic human motion, like walking, for example. I set up a video camera in front of a treadmill to record the motion of the body as it walked. I recorded the body from the front and the side to get a different view of the same motion. Viewing from the front clearly demonstrated the vertical motion of the person walking. The entire torso moves in a type of wave pattern what appears as up and down motion from the front view. This varies and becomes more irregular as the stride increases. From the side the torso may start to sway back and forth as the stride increases along with the wave motion as the body reaches the peek of the stride and one of the legs is extended upward. (Figure 29)

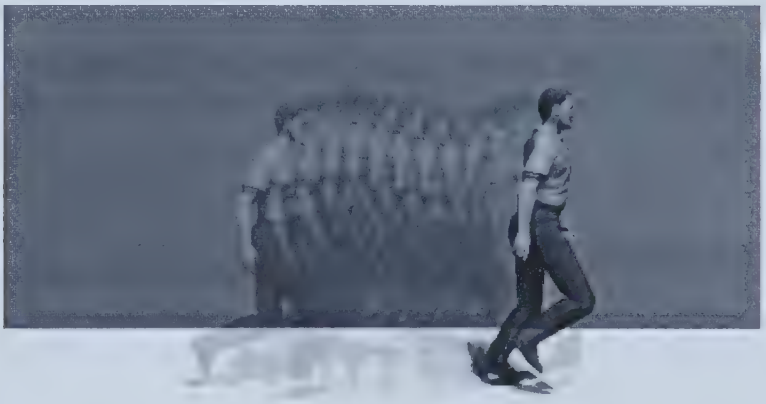


Figure 29

As the alternate leg moves forward we fall forward, the leg is extended out, and weight is transferred from the trailing leg onto the front leg which makes contact with the ground at precisely the right moment. The momentum from the weight transfer forces our body to pivot at the hip as we try to regain an upright posture before this cycle is repeated.

We perform this motion thousands of times a day without conscious thought, but for the animation every movement needs to be attended to in order to be accurate and not draw unwanted attention. Character development is dependent on the movements of the people in these scenarios, so creating believable movement is essential. Animation is constructed using what is called a wire frame mesh and texture wrapping. The mesh may be a simple grid or a series of connected polygons which form a skeleton just

below the texture. (See Figure 30). The higher the number of polygons, the smoother the character or object you are trying to create.

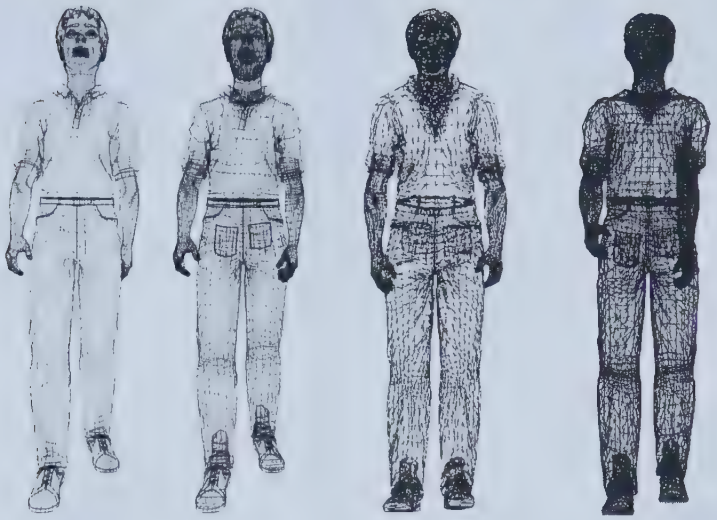
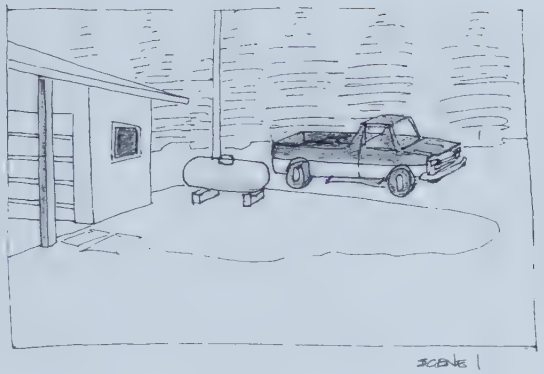


Figure 30 From left to right simple grid mesh, high density grid mesh, polygon mesh, NURB mesh

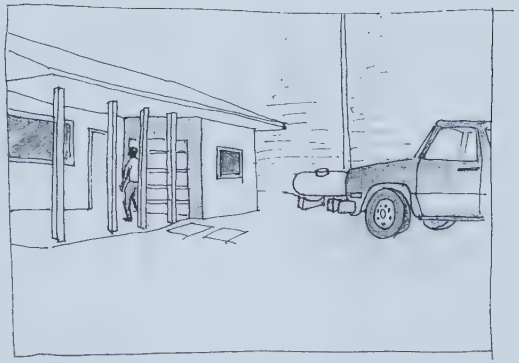
Of course the more of anything in computer structures, the larger the files and processing power needed to manipulate them. There is newer technology which deals with wire frames differently, called NURBS. These are a combination of objects which are created with shapes on splines or shapes on points. The combination shapes allow for variation of texture on the same object, for example an eye (smooth) on a crocodile (rough). A combination of wire frames and generated polygons were used to produce the re-enactments reported in this thesis.

The animation in this study used simple cut methods to forward the story and show the characters in the setting where the events were taking place. This is shown in the story board in figure 31. Even though the shots take place in different rooms they do not indicate simultaneous events but rather successive ones. In the court there are only two sides to the description of the events, the prosecution and the defence. It is important then that the scenario is seen as a single perspective. The same relay of information currently happens in a court of law in that the crown prosecutor tells the jury what happened based on the evidence, not a multitude of possibilities which all could have been committed by a single person. The defence gives an account which is contrary to the crown's. The other axioms are conventions which we understand and decipher but would not be used for this type of demonstration because they relate to narratives located in two places at once. This would raise

Figure 31



Scene 1 arrival - Truck comes down the driveway from behind the house. Evergreens line the drive. House to the left, propane tank and lamp post center.



Scene 2 arrival - Male 1 exists truck and approaches the house. Walks direct and in plain view of the people inside.

Scene 3 confrontation - Woman meets male 1 and an argument and struggle takes place. Motivation for male 1 is to reach male 2

Scene 4 confrontation - Male 1 throws the female to the ground and enters the house

Scene 5 shooting - Male 1 stops at the landing of the entrance and looks around. Male 2 comes from the back bedroom and down the hall. Immediately, male 2 fires the gun as he sees male 1 in the house.

Scene 6 killing - Female slowly rises from the ground and is hit in the head by the second bullet She tries to lay down on the ground and then collapses.

suspicions of credibility and admit more than one perspective or interpretation of story. Because the story events were determined, it was a simple matter of positioning the camera to capture the sequential order. In the scenario which demonstrates the element of motion the camera "pans " in each shot. The camera in the other scenarios which deal with texture and light, remains still.

Texture

Texture is an element closely related to the sense of touch and sight. Before we feel something with our extremities we have an idea of what the expected sensation will be. The sense of sight prepares the body for these sensations and once we come in physical contact with an object our guess is reinforced by the experience. Only when our expectation does not match our sense of touch are we tricked and jarred to reassess our experience. I do not believe it is important that we can touch the characters but it is important that the characters and the environment are dressed in a range of texture which is plausible at one end of a scale and more accurate to reality on the other. Texture is defined here as pattern and tactile qualities which are perceived by visual descriptors such as colour, shade and form. With its default setting of texture, the software for the characters provided a basis for the plausible. The forensic photos were the source for the realistic choices of texture. People are very attuned to recognize faked materials. This may have to do with our intimate knowledge of how they feel against our own skin.

Lighting

I drew on my experience as an interior designer and discussions with theatre (set and lighting) designers to ensure that the lighting which was demonstrated in the scenarios was typical of the dwelling where the incident took place. In the photographs taken of the crime scene I could see the type of fixture on the ceiling and the type of lamp typical of these fixtures. The positions of the fixtures were marked where possible additions were made to the virtual space which would have been typical of the house built at the time. It was also evident in the photographs that the finishing materials of the house had not changed, therefore it is probable that the lighting fixtures also had not been changed. Unfortunately, because of the restrictions of the software which I used to create the interior of the scene the test-rendered images came out too dark, giving a sinister look to the space. The time of the shooting was 4:20 pm in March. The sun was still out and with the lighting on in the house the room should be well lit. The contrast of the walls became greater than it would have been, and as a result additional lighting had to be added. The shadow patterns on the wall are more variegated than in the earlier, darker form. This is more consistent with the real space because of reflections and subtleties in light and shadow which are not easily reproduced in computer animation.

Conclusions about elements (motion, texture, lighting)

Admittedly, there are other equally strong elements which I could have included in this list. Because it was important for the elements to remain visual, sound was omitted. A number of comments were made about the inability to make a decision about the characters mood or their relationship with the other characters in the animations because there was no sound. To restrict the variables to visual elements it was necessary to leave audio to another study. Colour is another element which is not being tested in the study but has been present in all of the films. Many colour studies have been done and I felt that the omission of colour would be too great of a variance from reality. The viewers see in colour and it was the focus of the study to only deal with those elements that could be degraded or enhanced within ranges of arguable realism. It is important to know that other elements such as volume, scale, contrast as well as colour were included but not measured for effect, and were kept constant in order to measure those elements that did change.

The significant effects of the elements start to form a pattern in relation to specific categories of questions. Texture and lighting had the most effect on the viewer possibly due to the significant difference in the image. The motion state, although different from the none-state, had all the same image qualities but was more dynamic in its representation. Motion did rate significantly higher than the none-state in the level of realistic qualities but did not significantly change the opinion of the mood of the characters, or the mood of the viewer. Most importantly, it showed no effect in determining who was responsible for the murder.

The Ballot

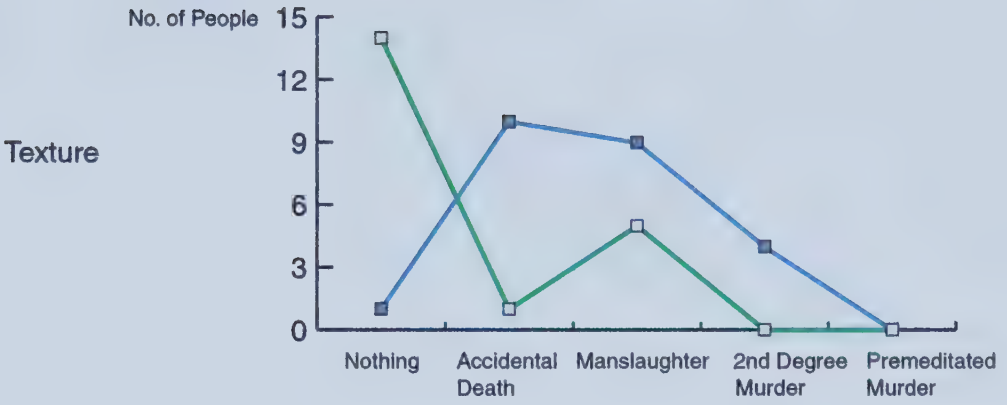
All the participants filled out a ballot form to determine the issue of penalty for either Male One, Male Two, both or neither of the male characters (see Figure 32). Because the ballot was to simulate jury procedure it was cast anonymously and not linked to the questionnaire in any way but was categorized by the type of film viewed. Statistically, this made it difficult to measure without a relationship to the demographic or quantitative analysis. However, it is useful in determining the difference in decision making tendencies of the groups. Male Two shows no significant difference in the range of penalty, with the largest portion of the responses falling between accidental death and manslaughter (sentence of 1-3 and 3-5 years respectively). It should be said that one of the benefits of animation cited by lawyers, could be the promotion of consistent sentencing. It is clear that some of the participants still have strong opinions on either end of the scale but these ballots are without the benefit of group discussions or the need to come to a consensus. The start of the deliberation would at least have the same distribution of moderates and extremists. For Male One a significant difference was in the texture film. A greater number of participants gave no penalty or specified a lesser penalty for sentences such as aggravated assault, or break and enter. The other animations had no significant effect and the severity of penalty remained relatively the same. Without the benefit of a judge's instructions on how to assess the penalty values, it is difficult to be definitive about the data collected in the present study. What it does say is that texture has some influence on decision making but there is no tendency toward greater severity of penalty. The texture outcome, if we consider majority rule, is the same as the actual outcome of the trial. Could the effect show a more logical method of thought process in the participants, comparable to judges rather than an emotional one? Future study may benefit from looking at what processes helped the jury derive their decision, should this result re-occur.

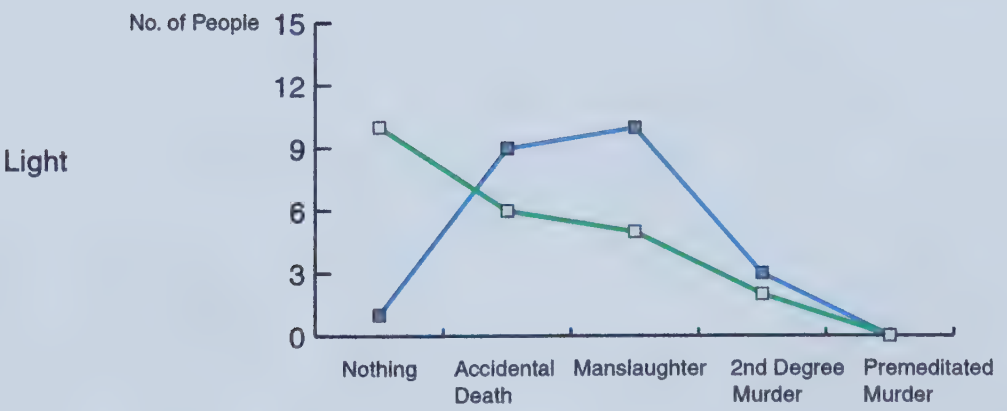
Review of the Study

Many suggestions for comparing different ways of demonstrating the crime had been made for re-enacting the scene, such as a puppet show, and schematic drawings. Creative variance of these types of demonstration methods allow viewers to develop their own variations of the scenario. The animations should enhance the viewer's ability to learn the information while allowing for possible variation to occur. Based on the range of responses, the possibility for other versions of the scenario would be acceptable to the audience. If the majority of the viewers had significant difference or significant similarity in answering the question about who was responsible it would suggest that the variables within the animation affected judgment. However, this study showed that strategies determining who was responsible as well as assigning penalty are the same for all the films. This would suggest that even though we are in different ways affected by the elements of imagery it does not affect the verdict. It may also be

elements inherent in the films which were not measured here but in that case they would have some opposite effect on the elements that were measured in order to give an even result. It would seem that these elements in and of themselves cannot influence judgment. (see Figure 33)

Figure 32
Anonymous ballot results for the 4 groups determining penalty





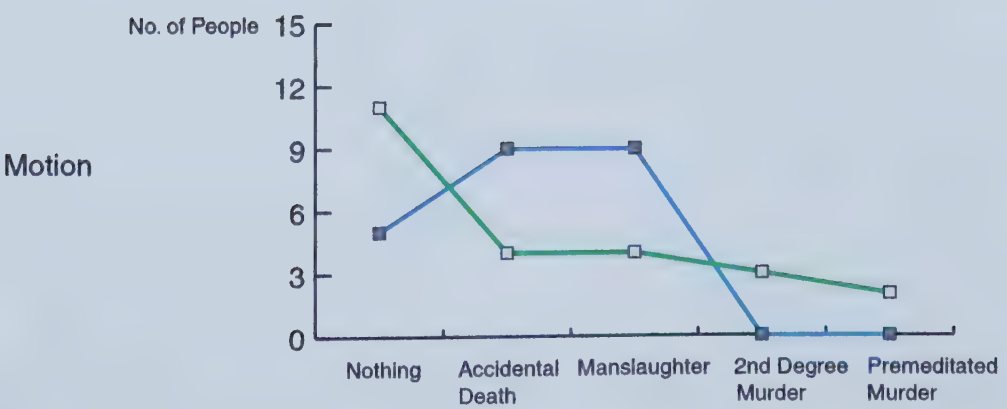
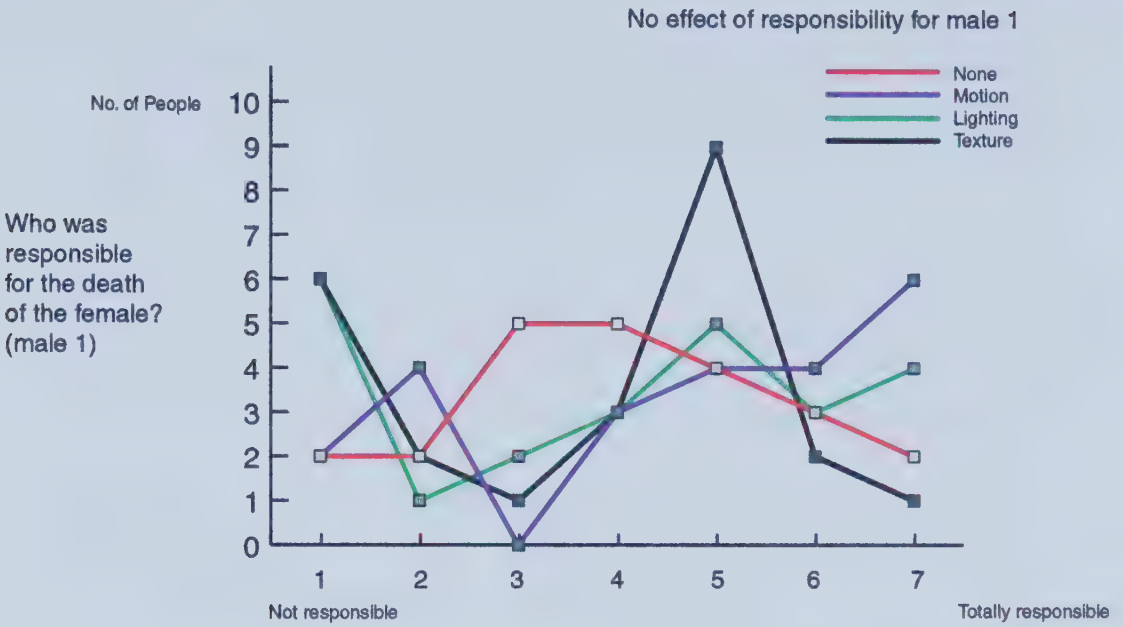
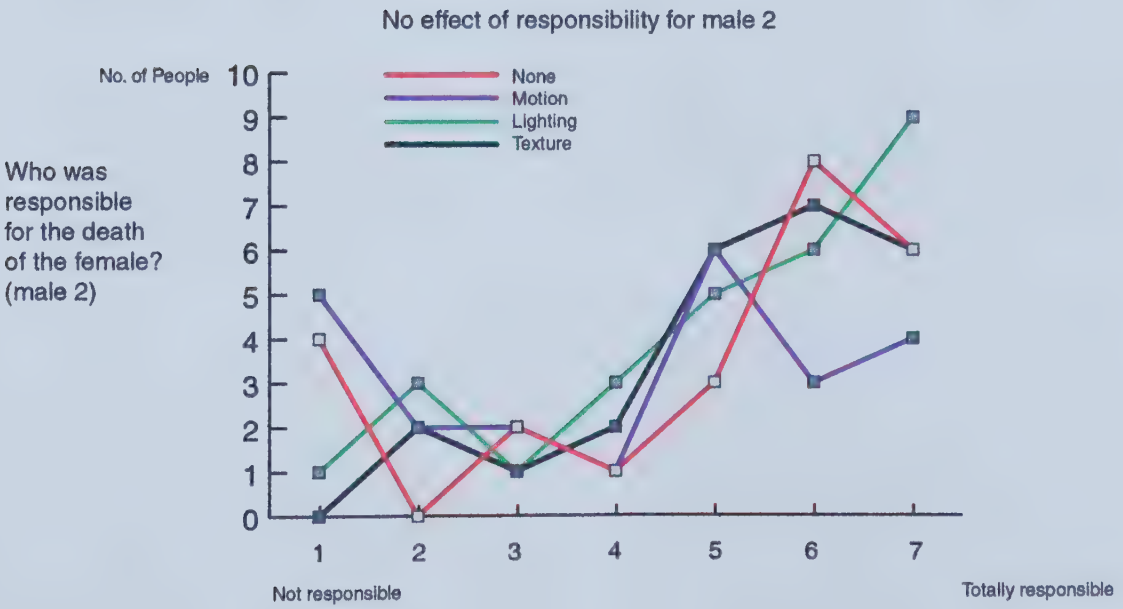


Figure 33
The total number of participants for each film was 24 except motion which had 23.





Conclusions

The study indicates that jurors are found to be influenced by the elements of lighting texture and motion and they become more engaged in the animation as these elements are introduced. This is shown not only in this study but in others as well (see pages 17 and 26). It is important that the films do not reach absolute realism in order for the viewer to be aware that it is a reenactment and not the crime captured on film. The variation of the elements did not however, affect the opinion of the jury about the actors responsibility or their judgement about the event.

The intensity of the reaction was greater in the jurors answers, both positively and negatively, relative to the none state offering some insight into these elements greater or lesser effect. It is likely that other visual elements might also influence the various reactions of the juries. In order to determine the overall effect of animation, each element must be examined separately as well as in combination.

Even though the legal establishment has reservations about reenactments in court it has to be remembered that these animations are only one element among a number of factors; social, cultural, environmental, that affect the jurors opinion about the nature of an event.

In order to understand the relationships of the elements at play we need to continue to understand the fields of law, psychology and animation which direct the interplay of these fields in the context of reenactments.

The legal system in Canada has shied away from using this type of demonstrative evidence yet the push for admissibility comes from outside as well as within the legal field. This study supports the merits of using animation for illustrating crime scenes, however, in closing, I must re-emphasize the need for continued study in this area.

Recommendations

Further to this study the following are suggestions to consider.

Technology

Existing software used to create the animated reenactments was extremely time consuming. It is hoped that if the Canadian legal system accepts the use of animation in court, then development of more efficient software for animation which is specific to reenactments of crime scenes will occur. Most computer animations take enormous amounts of processing power even to produce short films such as these. The size relationship of the image to human scale is a possible factor in the participants relationship to the film. High resolution images enable a larger projected image on to a screen without degrading its quality.

It is recommended to keep the image size small, and as a result keep the file size small, then enlarge the image when projecting the movies, thus reducing much of the production time.

Subjects for the study

It was difficult to assemble the juries in large enough numbers as well as in spaces which reflected the formality of the jury deliberation room. To do this study I relied on advertising posters and direct solicitation of strangers, which proved to be not the most effective strategy.

A sample of participants which simulates random jury selection can be best obtained through phone lists or mail lists. It is also recommended that the setting of the testing resembles as much as possible a jury meeting room.

Results

The present study involved the comparison of variations in one visual element at a time.

A cumulative study needs to be done to test the effect of permutations of visual elements on juries. To determine whether increasing the fidelity of information to reality results in a significant prejudicial effect. If it is intended to use a high degree of realism, it becomes necessary to secure a good animator and appropriate software.

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Alternate material

Movies:

Thin Blue Line - Docu-drama about a wrongfully convicted killer and how evidence was built up around a case based on assumption.(1991)

Hurrican - Drama based on the true story of Rubin "Hurrican" Carter. Who was falsely accused of murder. Directed by Norman Jewison, Starring Densel Washington (1999)

Ants - 3D animated film worker ants who save the colony by banding together. Industrial light and magic (1998)

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A Bugs Life - 3D animated film Walt Disney Production (1998)

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Mary K Kaiser Http:// vision.arc.nasa.gov/personnel/kaiser/kaiser.html (as of March 12 2000)

News group Http://Crimemap.org

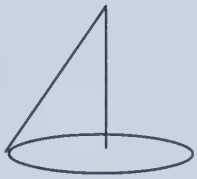
Appendix 1

Jeffery Johnson's check list of Hierarchical Structure from "Multidimensional Networks of Complex Systems"

1) Set hierarchical definitions: using 3-dimensional structure model

Atkin polyhedron

Venn set



2) Establish the relational structure of the hierarchical backcloth

3) Establish the Hierachical traffic on backcloth

4) Ensuring the hierachical traffic aggregate consistency

5) Seeking the mechanism of domain dependant dynamics

6) Relating time to structure and prediction.

Appendix 2

Reconstruction of a Shooting

This is an overview of a crime and the reconstruction and animation process that followed it. This is an actual event. The described animation was the first forensic computer animation introduced in a criminal trial in the state of Oregon.

The shooting took place in the parking lot of a convenience store in N.E. Portland during the winter of 1996. The suspect, who was being sought by police in connection with a domestic disturbance that had just occurred, was in the back of the van with a rifle. Officers spotted the van and looked for the suspect in the store after seeing that the cab of the van was unoccupied. Upon leaving the store and approaching the van again, they were fired upon through the center side window of the van on the passenger side.

Although the shooting occurred in February, Bob Davis and Burt Jurgens were called upon by the prosecuting attorneys in April to assist in a re-enactment and reconstruction of the incident in preparation for an anticipated trial in July. Davis and Jurgens used a Nikon Total Station to measure the scene with very high accuracy in three dimensions. The suspect vehicle was returned to the scene and repositioned in its original location based on measurements taken by detectives on the night of the crime and crime scene photos which showed the position of the van in relation to the front store windows.

The officers were making a divided approach to the van. One was on the store sidewalk and the other was walking along the backs of the parked cars. The first shot, which came through the heavily tinted window which was concealing the suspect, nearly struck the officer on the sidewalk. Both officers were forced to take immediate cover, which was the green car next to the white blazer. The Special Emergency Response Team (SERT) was activated almost immediately and responded to the scene to assist the officers, who were held down by the suspect's rifle fire. Like the suspect's van, the green car, which happened to belong to a clerk at the store, was meticulously repositioned in its original location of the night of the crime. Davis and Jurgens used the permanent fixtures, the building, the sidewalk, the parking lot, and the overhang, as a foundation on which they rebuilt the rest of the crime scene. Fortunately, there was other evidence there that had not been moved. Bullet holes in the store ceiling and walls had not yet been repaired. By measuring these points in three dimensions, they could establish one anchor point of each bullet's path. The SERT officers took positions around the corner of the building by the dumpster. The patrolmen were extracted from the scene. The confrontation continued for a long time as far as gun fights usually go. One officer suffered minor injuries when a shot passed through the dumpster and sprayed him with shrapnel. A far more serious injury was suffered by the officer on point. A bullet struck the magazine well of his weapon and his left hand causing extreme damage to his hand.

When building a 3-D model of the scene, Jurgens and Davis used the measurements they had obtained with the Total Station to build all significant objects in the scene to the exact size and scale. For vehicles that had not been measured at the crime scene, they used crime scene photos and still frames taken from the crime scene video tapes to get the registration information on the vehicles. Models of the vehicles were built to their actual size based on manufacturers' specifications. They were very carefully positioned in the 3-D model by using numerous photos and the crime scene video to establish their original location.

When he was struck in the hand, the officer was knocked to the sidewalk on his left side and further away from the cover of the building. His cover officer was the third officer to be injured as he also left the protection of the building behind, briefly, as he moved out to grab his fallen partner and bring him back to safety. The shot struck the wall low and near the corner of the building. After ricocheting off the face of the building, it struck the officer's arm. By establishing the position of all of the objects in the scene and determining where several of the suspect's shots had ended up (ceiling and wall holes, holes in the dumpster, and a gouge in the face of the building where the shot ricocheted), Jurgens and Davis were able to begin reconstructing the bullet paths. This was made much easier by the fact that witnesses established that the suspect was firing through a hole in van window that was only about 8 quot; in diameter and was near the center of the window (after the incident, the entire window glass had been destroyed).

The suspect was arrested a short time later without any other casualties occurring. He would remain in custody facing charges of attempted aggravated murder. There would never be any question of who was in the van and who fired the shots. The issue was going to be whether or not the jury would believe the suspect's claim that he had panicked and was firing blindly into the night or whether they would see it as the investigators did, a series of aimed shots that came close to killing their intended targets on several occasions.

The real advantage of using 3-D modelling as an investigative tool comes when the model has been built and you start to ask "what if?" questions. In this case, for any given shot for which a striking point was known, a line could be projected back to where the shooter was believed to be. One could instantly see whether it was a feasible explanation or not. Possible interfering objects like other vehicles and walls could be immediately accounted for, unlike on a 2-D diagram where a line crosses over many objects but you do not know if it is above, below, or in the middle. The prosecutors knew that this guy was going to make them convict him in a trial. He had nothing to lose and no one was going to offer him a deal to plead out on this one. They also knew that he was not going to be acquitted of all charges, but what they did not know was whether or not they were going to be able to make sure that he stayed in long enough that he would never have the chance to do something like this again. For the relatively few details that could not be dealt with entirely on the basis of physical evidence alone, the officers provided the necessary information to fill in the gaps both during the reconstruction/re-enactment work at the scene and later, after the animation had been completed.

Officers watched the animation before the trial. Fortunately all of the witnesses agreed that it was a true and accurate depiction of the events that had occurred. Where there were minor differences, such as the position and posture of an officer standing behind the dumpster, the animation was changed to match the witness' statement if it was not in conflict with physical evidence or other statements. A motion to suppress was filed and both sides of the issue were argued before the court before the trial began. The court ruled in favour of the prosecution and the animation was presented to the jury during the trial. The defendant was convicted. He received a sentence of 435 months (over 36 years).

The level of detail used in this animation is fairly low. This was advantageous for two reasons in this case. The first was that this process is extremely computer intensive and a higher level of detail used on the computing resources that were in use at the time would have quickly made this project unfeasible within the time constraints that existed. The animation was modelled and rendered with Autodesk's 3D Studio Release 4. It was rendered on a P133 with 64MB of RAM. The final version was over 6 minutes

long. The animation was transferred to VHS tape (640 x 480 resolution, 30 frames per second) for courtroom presentation. Each individual frame took up to one minute to render. There were over 10,000 frames in the animation. The second reason [for the use of low resolution images] is that one of the defence arguments against allowing the animation to be used in the trial was that it would lead the jurors to believe that this was a movie of what actually happened and that they would be likely to give the animation more weight than the witness testimony since they had "seen" the incident happen. The judge's opinion was that no one was arguing that the animation was a complete depiction of the incident, but rather an illustrative tool, much like a diagram but more useful, and that the jurors were not likely to be overly influenced by the "realism" of it as it was quite obvious that it was simply a model and that the simple shapes and lack of detail where detail was not required made it very clear what it was. 3D Studio Max and uses a Windows NT Pentium Pro 200 Mhz dual processor workstation for modelling and rendering (either on the workstation alone or over a network).

Appendix 3
Dynamics and the Problem of Visual Event Recognition
by Geoffrey Bingham

14.2 The Evidence For Event Recognition

Evidence has been amassed over the last 30 to 40 years demonstrating irrefutably that people are able to recognize specific types of events and specific properties of events via detection of particular forms of motion. The majority of the extant research in visual event perception has been focused on scaling problems, that is, the way that magnitudes associated with particular event properties are apprehended. This research has included investigations on the perception of the sizes and distances of objects in free fall (Johansson and Jansson, 1967; Muchisky and Bingham, 1992; Watson, Banks, von Hofsten, et al., 1993); perception of the lengths of swinging pendulums (Pittenger, 1985, 1990); perception of amounts of lifted weight (Runeson and Frykholm, 1981, 1983; Bingham, 1985, 1987b); perception of relative amounts of mass in collisions (Proffitt and Gilden, 1989; Runeson, 1977; Runeson and Vedeler, 1993; Todd and Warren, 1982); perception of the age of growing heads (Mark, Todd, and Shaw, 1981; Pittenger and Shaw, 1975; Shaw, Mark, Jenkins, et al., 1982; Shaw and Pittenger, 1977, 1978; Todd, Mark, Shaw, et al., 1980); perception of the elasticity of bouncing balls (Warren, Kim, and Husney, 1987); and perception of the time of contact of projectiles (Lee, Young, Reddish, et al., 1983; Todd, 1981). All of these scaling studies have implicitly involved the problem of recognition because any property or dimension to be scaled must first be recognized. For instance, to judge pendulum length via the period requires that an observer recognize the freely swinging pendulum event as well as the event property, the pendulum length. Successful performance in all of the cited scaling studies has implied that observers have been able to recognize the event properties whose scale values they judged. To this may be added evidence from investigations explicitly on recognition.

The inaugural studies on visual event recognition include those of Duncker, Michotte, Wallach, and Johansson. Duncker (1929/1950) demonstrated the recognition of a rigid rolling wheel via the relative motions of points on the hub and the rim. Michotte (1963) studied the recognition of launching vs. triggering events as the timing along trajectories was varied. Wallach and O'Connell (1953) investigated the recognition of wire frame objects via the so-called kinetic depth effect. Finally, Johannson (1950), in giving event perception research its name, placed it in the context of established problems in perceptual research, namely those of perceptual organization and constancy. Manipulating the motions of points or elements in a two-dimensional display, Johansson sought properties of relative motions that would result in the perception of a single coherent moving three-dimensional object. In addition, Johansson distinguished between displays that yielded perception of rigid vs. nonrigid objects and inquired as to the conditions yielding the shape constancy of rigid objects (Johansson, 1950, 1964, 1973, 1985). This led to an entire area of research on object recognition called "structure-from-motion" in which the assumption of "rigid motion" has been used in theorems proving that three-dimensional object structure can be derived from sampled optical transformations (Hildreth, 1984; Hildreth and Hollerbach, 1987; Hildreth and Koch, 1987; Longuet-Higgins and Prazdny, 1980; Marr, 1982; Prazdny, 1980; Ullman, 1979).

"Structure-from-motion" research owes as much to Gibson's studies on the visual control of locomotion and flight (e.g., Gibson, 1955, 1958, 1961, 1966; Gibson, Gibson, Smith, et al., 1959) as to Johansson's studies on event perception. The rigid/nonrigid distinction has been used to investigate perspective transformations that occur as a point of observation is moved through the environment. The assumption that the environment should be entirely rigid (and therefore static) yields a reasonable first approxima-

tion to optical flows encountered during locomotion (Nayakama and Loomis, 1974). However, the ultimate weakness of this approach is revealed in the context of the more general problem of event recognition. Researchers have claimed that the rigid motion assumption is required for unique interpretation of flow patterns because nonrigid motions allow an indefinite number of interpretations in terms of depth and motions (e.g., Hildreth and Hollerbach, 1987; Nayakama and Loomis, 1974). However, "nonrigid" has been used here incorrectly to mean "arbitrary" motion. Nonrigid motions are not arbitrary, as shown by the number of distinct kinds of "nonrigid" events that are recognizable.

In fact, the majority of studies demonstrating and investigating visual event recognition have involved nonrigid motions (Bingham, Rosenblum, and Schmidt, in press; Cutting, 1982; Fieandt and Gibson, 1959; Jansson and Johansson, 1973; Jansson and Runeson, 1977; Todd, 1982), and in particular those of human actions (Barclay, Cutting, and Kozlowsky, 1978; Cutting, 1978; Cutting and Kozlowsky, 1977; Cutting, Proffitt, and Kozlowsky, 1978; Frykholm, 1983; Johansson, 1973, 1976; Todd, 1983). These studies alone, however, do not reflect the proportion or variety of recognizable events involving different kinds of nonrigid motions. Such motions include varieties of bending, as of a human trunk or elbow, a paper clip or a tree limb buried in snow; types of folding, tearing, and crumpling, as of pieces of paper, the body of a car, or a loaf of fresh Italian bread; varieties of breaking, as of glass, a cookie, a wooden board, or a loaf of stale Italian bread; types of elastic stretching or compressing, as of a hair net, a bouncing ball, a tree branch blowing in the wind, vibrating jello, or a human face forming various expressions; kinds of plastic deformations, as in forming clay figures, kneading bread, making snowballs, or leaving footprints in soil; types of liquid flows involving the pouring, running, bubbling, and splashing of liquids of varying viscosity, as of water, oil, molasses, or thickening gravy cooking on the stove; varieties of flows of gases, as of steam or smoke in air; snow or leaves blown in a breeze, and so on. The great diversity of different types of nonrigid events that might be perceptually identified renders any simple distinction between rigid and nonrigid far too weak and inadequate to address the problem of visual event identification.

The rigidity of objects is a physical property which, like elasticity, plasticity, or fluidity, can generate specific types of motions. The question is whether observers are able to recognize such properties in specific instances and if so, how? More generally, the identification problem is, first, to discover what types of events and event properties observers are able to recognize and, second, to describe the information enabling them to do so. For instance, Bingham et al. (in press) have shown that observers were able to recognize events including free fall and elastic rebound, swinging pendulums, rolling balls, stirred water, objects dropped into water, and tickets of paper blown and falling through air, all from the forms of motion displayed in patch-light video recordings.

The patch-light technique isolates motion as information from static figural properties. Events are filmed so that bright patches of reflective material placed on surfaces in events appear against a dark (structureless) background. When these displays are freeze-framed, they appear as only a random array of irregular patches. When set in motion, the recorded events are typically recognized quite readily.

In the Bingham et al. study, observers' descriptions of the patch-light events reflected the underlying types of dynamics rather than simple kinematic similarities like the presence or absence of rotational motion in the display. Events involving rigid-body dynamics were described as more similar to one another and distinguished from hydrodynamic or aerodynamic events which were similarly grouped. Observers also distinguished the inanimate motion of a falling and bouncing object from the animate motions produced when the same object was moved by hand along the same path, to the same endpoints, and at the same frequency. Motions produced by the biodynamics reflected increases in

mechanical energy, while those produced only by rigid-body dynamics reflected strict dissipation of energy. In all cases, recognizably different events were produced by different generative dynamics.

The forms of motion corresponding to each event were sampled from the video recordings and captured in phase-space trajectories. In each case, the trajectory form reflected the dynamics that generated the form. For instance, as shown in figure 14.1, the free fall and bounce produced a parabolic trajectory (characteristic of gravity) with a flat base (corresponding to the impact and elastic rebound) followed by a decelerative parabolic trajectory rising to a height diminished by energy dissipation. In contrast, the object moved by hand produced an elliptical trajectory (characteristic of human limb movement) with a half-flat base (corresponding to inelastic impact and loss of energy), followed by an accelerative elliptical trajectory (which reflected energy increase). These spatiotemporal forms in optical flows provided visual information enabling observers to recognize the corresponding events. Such information is paradigmatic of the understanding of perceptual information developed by Gibson.

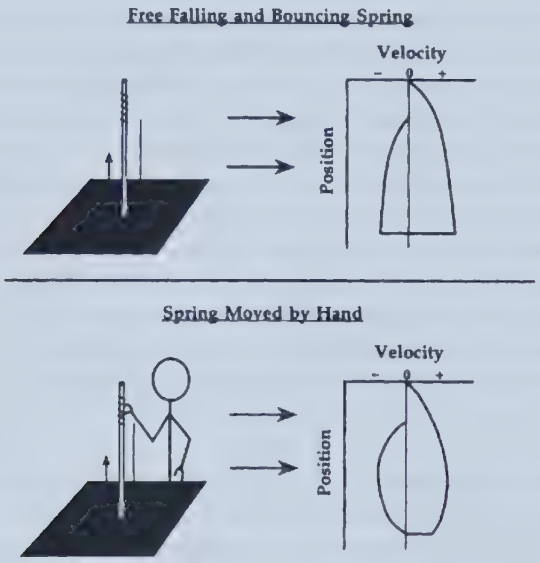


Figure 14.1 (Top) The phase trajectory of a free-falling and bouncing spring. (Bottom) The phase trajectory of the same spring moved by hand to the same endpoints at the same frequency.

14.3 Direct Perception: Information and Informational Bases

How can optical patterns have perceptual significance? How can they provide information about objects and events in the surroundings? How can they specify what is happening? Two classic solutions to these questions were rejected by Gibson (Gibson, 1950, 1966, 1979; Reed, 1988; Reed and Jones, 1982). The first, usually attributed to Berkeley, is that optical patterns gain significance by virtue of associations with haptic experience, i.e., touch and kinesthesis. The difficulty with this idea arises with the realization that haptics only functions well in the context of voluntary movements. Objects and properties of objects (e.g., surface compliance, surface texture, weight and inertial distribution, shape, etc.) can be identified rapidly and reliably only when an observer is allowed to actively explore and manipulate an object (Gibson, 1962, 1966; Klatzky, Lederman, and Metzger, 1985; Lederman and Klatzky, 1987). Understanding

how spatiotemporal patterns of tissue deformation provide information about objects and events (including the perceiver's own activity) is, if anything, a more difficult problem than that encountered in vision. This is, in part, because the problems in understanding the control and coordination of actions are inherited as part of the problem of understanding haptics (although ultimately action is a part of the problem of visual recognition as well) (Bingham, 1988). More to the point, the effective patterns of tissue deformation that impinge on the sensory receptors in haptics are less accessible to measurement and manipulation in experiments. Finally, and most important, it is spatiotemporal patterns of tissue deformation, i.e., change in geometric configurations over time, that provide information in haptics just as in vision (Bingham, Schmidt, and Rosenblum, 1989; Pagano and Turvey, 1993; Solomon, 1988). This realization undercuts any intuition that a solution to problems in vision, if seemingly insoluble, should be found only in haptics.

The second classic solution is that optical patterns have significance by virtue of a similarity relation to that about which they provide information, i.e., that optical patterns are copies of environmental patterns. Gibson also rejected this alternative. Gibson's analysis of optical occlusion is a paradigmatic case (Gibson, 1979; Gibson, Kaplan, Reynolds, et al., 1969). The deletion of optical elements along a boundary specifies one surface becoming hidden by another by virtue of a change in perspective. With progressive deletion, optical elements cease to exist in the optical pattern. However, the significance of this optical flow pattern does not inhere in a similarity relation to what is specified. The optical pattern does not specify surface elements going out of existence in the environment. Why not? Because surfaces do not go out of existence neatly and quietly at an edge, although they do go out of existence in a variety of other ways constrained and determined by natural laws. Surfaces can burn, explode, evaporate, melt, break, and so on. Each of these types of events produces corresponding types of optical transformations that are distinct from progressive deletion along a boundary. Also, each of the former events is irreversible, whereas the hiding of a surface via change in perspective is reversible, yielding accretion of optical elements at a boundary. Thus, Gibson argued that the particular pattern of optical flow can specify an event to which it corresponds by virtue of natural laws that determine the particular form of both the event and the optical flow.

The historical precedents to this understanding take us back at least as far as Hume (1739/1978). He argued that perception only has access to motions, not causes, because optical (or acoustical, etc.) patterns involve space and time, but not mass or force. His skeptical argument was a natural extension of arguments to the effect that perception only has (direct) access to "phenomena" described via only two spatial dimensions and time because the third spatial dimension is absent in optical pattern. Such phenomenalism has been standard fare in the philosophy of perception and widely advocated despite its leading inevitably to the absurdities of solipsism. Rejecting phenomenalism requires that perception have direct access to information specifying substantial properties of the surroundings (Shaw, Turvey, and Mace, 1981; Turvey, Shaw, Mace, et al., 1981).

Two hundred years later, Michotte (1963) performed demonstrations which contradicted Hume's conclusions. The irony is that Michotte used technology that was available to Hume so that Hume might have made the discovery himself. Michotte devised a way to simulate linear collisions in displays that enabled him to perturb the kinematics without concern for underlying dynamics. (See Michotte, 1963, for details. This is now achieved using computer simulations) When shown Michotte's collision displays, observers recognized them as collisions. In these displays, one simulated object approached a stationary object, contacted it, and stopped moving, while the contacted object instantly carried on the motion. Michotte then inserted a brief delay at the point when the two simulated objects came into contact so that the

second object hesitated for fractions of a second before beginning to move. The result was that observers no longer recognized the display as of a collision. The slight perturbation changed the perceptual significance. The implication was that particular kinematic patterns have particular perceptual significance.

The upshot was that Hume's argument should be turned on its head. Indeed, causal constraints on events produce invariant forms of motion given invariant initial conditions. The invariance is a reflection of the underlying determinism which allows motions (and corresponding optical patterns) to be informative. They are informative by virtue of unique correspondence. The correspondence is enforced by natural laws, i.e., by dynamics. Note that not just any kinematic were rather odd. Forced to describe what they perceived, observers rather creatively described the display as specifying a "triggering" event, as if the first object triggered the release of energy stored in a spring which then sent the second object on its way. However, the instantaneous acceleration of the second object does not look exactly like such a triggering event. Runeson (1977) pointed out that Michotte did not manipulate simulated dynamics to produce his displays and thus the simulations were inaccurate and the displays rather ambiguous.

The final difficulty underlying the problem of event recognition is the degrees-of-freedom problem, that is, the problem of reducing the complex and large number of distinct motions mapped from an event will contain an extremely large number of distinct trajectories. Any event consists of a continuous spatial distribution of points, each following a different trajectory. Only portions of the original event kinematics find their way into the optics. During an event, points go out of and come into view as they are occluded by other parts of a moving object or by surrounding objects. This happens not only with a rolling ball but also as limbs appear and disappear behind one another when a person locomotes or when a tree blows in the wind. It occurs as waves on the ocean occlude one another and passing vessels, as cars occlude one another in traffic, or as pedestrians occlude one another on city sidewalks, as a dancer performs pirouettes, as one stirs one's oatmeal, and so on. The result is that most any given trajectory is sliced into myriad disjoint pieces which, together with those from other trajectories, produce a massive collection of nonidentical trajectory pieces. The disjoint character of the pieces from a given trajectory coupled with the simultaneous presence of arbitrarily close pieces from distinct trajectories prevents the simple reconstruction of individual trajectories. Given such a tangled mass of trajectory pieces, how might a single, unitary, and coherent event be apprehended? I will demonstrate how symmetries apparent in the layout of optical trajectories can allow the dimensionality to be reduced so that the underlying form might be apprehended. The suggested bottom line is that the global structure of event trajectories is required to yield a specification of events.

14.5 The Degrees-Of-Freedom Problem In Visual Event Perception

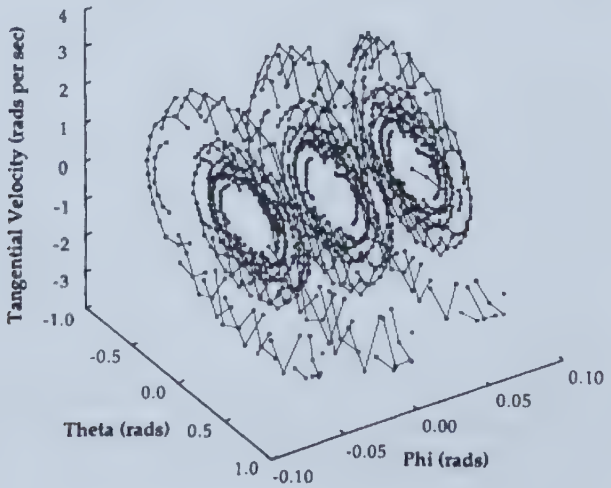
Nearly all extant analyses of "structure from motion" use the rigidity assumption (e.g., Andersen, 1990; Horn, 1986; Koenderink, 1986; Koenderink and van Doorn, 1975, 1976, 1987; Lee, 1974, 1980; Longuet-Higgins and Prazdny, 1980; Nakayama and Loomis, 1974; Owen, 1990; Rieger, 1983; Rieger and Lawton, 1985; Ullman, 1984; Warren, 1990; Waxman and Ullman, 1985; Zacharias, 1990). The rigidity assumption has been used because it drastically reduces the degrees of freedom in optical flow. Using results from analytical mechanics (Rosenberg, 1977; Whittaker, 1944), the motion of a rigid body can be described in terms of the translation of its center of mass combined with a rotation around that center. Alternatively, translation and rotation relative to the point of observation can be used. In either case, the positional degrees of freedom of the three-dimensional motion are reduced from 3n degrees of freedom, where n is the number of distinguishable points in the body, to 6 degrees of freedom, 3 to specify the position of the center of mass and 3 to describe the body's orientation about its center. In mechanics, additional

degrees of freedom are required to specify a body's state of motion. The velocities (but only the velocities) corresponding to each of the positional degrees of freedom must also be specified at some time, to. When these are specified together with a dynamic, the subsequent motion of the object is determined.

Ultimately, however, the rigidity assumption is untenable because it requires that an observer know in advance what he or she is perceiving to be able to perceive, i.e., a rigid-body event. This is an obvious paradox. Alternatively, the assumption restricts the relevant models to an unrealistically small set of perceivable situations, excluding any sort of nonrigid event. On the other hand, without the rigid-body assumption, the degrees of freedom required to specify the state in an event is 6n, i.e., 3 positions and 3 velocities for each distinguishable point. Depending on how one distinguishes points on an object surface (with the projection to optics in mind), this number grows indefinitely large fast. Furthermore, the problem projects right into the optics despite both the loss of points via occlusion by opaque surfaces and the reduction to a total of four coordinates for each point in the optical flow (2 positions and 2 corresponding velocities).

The nature and severity of this problem will be conveyed by returning to the rolling ball example. The kinematics of the event were described in spherical coordinates with the origin fixed at an unmoving point of observation located about 2.5 m from the event. The trajectories of a mere 12 points on the surface of the ball were selected for study, 4 points at 90-degree intervals around the ball in each of three planes parallel to the plane of motion, one plane at the center coincident with the plane of motion and one plane to either side at 70% of the distance from the center to the side of the ball. In other respects, the simulation was the same as described earlier, including the duration, which was 12 seconds. The resulting event trajectories were projected into optical flow.

The optical flow trajectories were captured in a three-dimensional optical phase space by using q and f position coordinates together with the tangential velocity to the optical path or orbit. q and f are visual angles in a polar projection appropriate for viewing at nearer distances. Only components perpendicular to the visual direction at each point in the event projected into the optics, each scaled by the distance along the visual direction. However, as the ball rolled, each point on its surface successively went out of view as it rolled underneath the ball and then into view as it rolled over the top of the ball. The result was that only discontinuous pieces of trajectories appeared in the optical flow, including only those portions of the trajectories that were not occluded by the ball itself. The optical phase portrait appears in figure 14.6.



If we were able to count only single trajectories associated with each of the 12 points on the ball, then the number of degrees of freedom would be 12 x 4 coordinates = 48. However, as can be seen in figure 14.6, it is not obvious how the various trajectory pieces go together. The trajectories are the trajectories in optical flow reduced to the relatively few degrees of freedom associated with the coherent and well-formed motions in recognizable events? The effect of occlusion combines with the degrees-of-freedom problem to exacerbate the problem by orders of magnitude. Resort must be made to time-extended samples of optical flow to find enough structure to solve the identification problem. (Time-extended trajectories also yield stability of the optical structure in response to perturbation by noisy measurements.) The strategy will be to find symmetries among the trajectories in the phase plane portrait and to use them effectively to collapse the structure, reducing the degrees of freedom and, at the same time, obtaining coherence and revealing the underlying form. 9

A glance at figure 14.6 reveals that the phase trajectories contain a number of symmetries (i.e., commonalities of form) that might be used to reduce the degrees of freedom in the optical flow. For instance, the spiral on the phase plane, characteristic of damped oscillatory events, can be seen in common across the three sampled planes of motion, although this form becomes rather lost among the overlapping trajectory pieces past the first cycle. In an earlier section of this chapter, the optical flow from the rolling ball was described using properties such as the contour of the ball's image and the centroid of the image. The advantage in deriving trajectories from these image properties was that the issue of occlusion was avoided, i.e., the resulting trajectories were continuous.

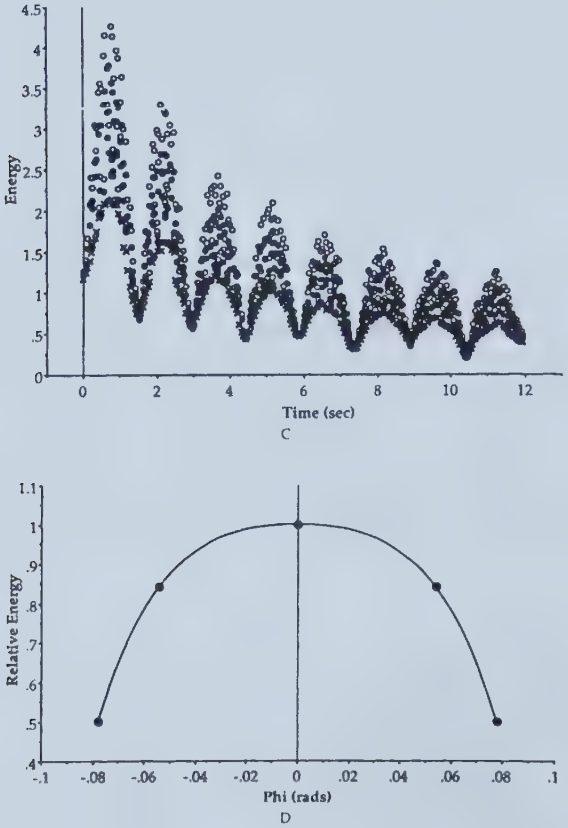
To illustrate this, the flow at 5 points in the ball's image was computed including the centroid as well as the front, back, and opposite side points on the contour relative to the common direction of motion, The resulting optical trajectories were plotted in figure 14.6 where the spiraling forms of the trajectories could be seen much more clearly, as could the symmetries among the trajectories. The continuous trajectories in figure 14.7 certainly represent a reduction in the degrees of freedom from those in figure 14.6.

Note that in a patch-light display there is no closed, continuous contour forming the boundary of the ball's image. There is only a random array of moving patches yielding trajectories, as in figure 14.6. The event is nevertheless identifiable. The question, therefore, is how might we derive the coherent trajectories in figure 14.7 from those in figure 14.6? To solve this question, we need to examine the structure of the trajectories appearing in figure 14.6 more closely. Figure 14.8A shows the trajectories projected from the 4 points around the middle of the ball. The highly structured character of the phase portrait is quite apparent in this figure. Each separate trajectory piece or hoop corresponds to the motion of a single point on the ball as it rises up from the back over the top of the ball and disappears in the front. The variations in q distances between the ends of each hoop in turn correspond to the variations in image size. The rounded form of the hoops is related to the rotation of the ball. The rounded trajectory form is created as the rotational velocity component is progressively added in and then removed as a point travels from the back over the top to the front of the ball. This first symmetry is common to the trajectories in every plane parallel to the plane of motion and will ultimately allow us to collapse the trajectories in all the planes down to those in one plane, for instance that in figure 14.8A. But first, we should analyze the structure in that plane.

The most important symmetry is the envelope surrounding the train of successive hoops. This provides the means of deriving the trajectories of figure 14.7 from those of figure 14.6. As can be seen in figure 14.8B, where I have plotted one cycle of the motion, the trajectories from figure 14.7 form the boundary on the envelope of trajectory pieces from figure 14.6. The bottom ends of the hoops correspond to the

front and back occluding contours of the ball's image. The trajectories of these contour points are implicit, yet apparent in the flow from a mere 4 points. If the trajectories of more points were to be included, the contour trajectories would be more densely specified. The same is true of the image centroid, although in that case it is the apex of successive hoops that is involved.

An alternative and natural coordinate system in which to capture these trajectories is in terms of a phase angle and an energy-related measure of radial distance which I will call "energy." These are polar coordinates on the q-by-tangential velocity plane (i.e., the plane in figure 14.8A and B) with the origin in the center of the spiral. 10 Thus, these coordinates are intrinsic to the phase portrait. They are determined by landmarks on the trajectories themselves, namely, the points of peak and zero velocity. As implied by the coordinate labels, these coordinates also relate directly to the underlying dynamics. When the trajectories in figure 14.8B were plotted in figure 14.8C as energy vs. time, the manner in which continuous trajectories bounded the envelope of the trajectory pieces could be seen quite clearly.



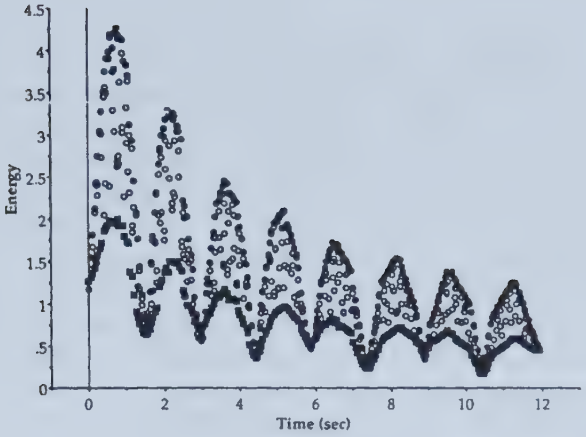
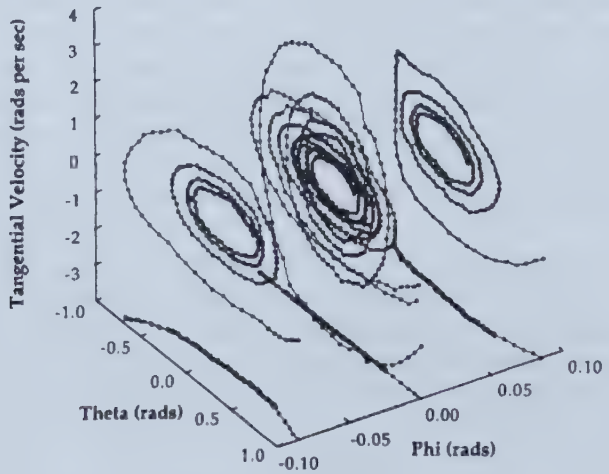


Figure 14.8 (A) Trajectories from 4 points around the midline of the ball. The 4 points in turn are represented by open circles, filled circles, open squares, and filled squares, respectively. Note that without these symbols, it would be impossible to determine which trajectory pieces represent a given point in common. (B) One cyclefrom the trajectories in figure 14.6A together (open circles) with midline trajectories from figure 14.5. The contour point on the front of the ball is represented by filled squares; the back of the ball by filled triangles, and the center of the ball image by filled circles (C) The energies for all of the trajectories from figure 14.9A and B plotted against time. Open circles represent the 4 points tracked around the midline of the ball. Filled circles represent the center point of the ball image. Filled squares represent contour points.

Returning to figure 14.6, I note that the properties revealed on the center plane obtained as well on the planes to the side. This suggests the solution to the next problem, which was to relate the motions on side planes to those on the center plane. The three sets of trajectories were 1:1 phase-locked. This could be seen by linearly regressing the phase angles (i.e., the first polar coordinate) for corresponding center and side points as "parameterized" by time. This is shown in figure 14.9A. The results were slopes near 1 (=.97 or better), intercepts near 0 (±.002 or less) and r2 = .999 in all cases. The phase-locked relation between the center and side trajectories meant, given the symmetry of form, that I could collapse the different sets of trajectories by normalizing to a common scale, e.g., rescaling by dividing in each case by the peak energy and reducing all trajectories to a common set with a peak energy of 1. These, in turn, could be reduced to trajectories of the same form as the center trajectories appearing in figure 14.7.



Of course, these symmetries of form also serve to make obvious the differences in scale among the sets of trajectories. This is important because the differences in energies (or radial lengths) is also informative. As is apparent in figure 14.7, the sizes of the spirals decrease from those corresponding to the middle of the ball to those at its sides. The relative heights of energies on the center plane, on the plane 70% of the distance to the side contour point, and at the side contour point appear in figure 14.9C plotted against time. The energy of the center points was linearly regressed on that for corresponding side points as parameterized by time, as well as on the energy for points on the contour at the back. The results are shown in figure 14.9B. Center point energy regressed on energy for side points 70% of the way to the outside edge of the ball yielded slopes of .84 with intercepts near 0. When center point energy was regressed on energy for the side point on the contour, the mean slope was .52. When center point energy was regressed on energy for the back point on the contour, the mean slope was .47. These results mean that if I assign 1.0 to the height of the trajectories along the middle of the ball, then the height of the trajectories 70% of the distance toward the sides is .84, while the height of the trajectories on the side contour is .52 (and on the back contour, .47). The relative heights of the middle trajectories, the side point trajectories, and the side contour point trajectories were plotted in figure 14.9D against their (mean) f-coordinate values respectively and fitted with a polynomial curve. There one can see that these relative energies represent the shape of the ball.

Undoubtedly, I could find additional information in the qualitative properties of these trajectories with further analysis. These trajectories are replete with structure that can be discovered via processes sensitive to the symmetries among trajectory forms. Once discovered, the symmetries enable a reduction of the degrees of freedom and a recovery of coherent form which relates directly to the generative dynamics.

14.7 The Necessity Of Analyzing Rate Structures In Optical Flow For Event Recognition

Confronting the problems associated with the rate structures in events is not optional in the study of optical flow. By definition, information in optical flow is found in the time evolution of spatially distributed optical structure. One can represent the spatial distribution of the instantaneous values of rate variables as a vector field, but such a snapshot will fail to capture structure specific to given events.

The amount of information contained in the optical phase-space trajectories for the rolling ball should be compared to that contained in the instantaneous optical flow field analyzed in the majority of studies on optical flow. Orbits corresponding to the middle and side point trajectories were projected on the theta-phi plane in figure 14.7. That these orbits in theta-phi configuration space contain considerably less information is rather apparent. The instantaneous optical flow field would correspond at some arbitrary moment to a set of 2 successive points along each orbit projected on the floor of figure 14.7 and the line drawn between the 2 points in each case. The result would be three very short line segments. This is not quite correct, however. The more appropriate projection would be from points along trajectories in figure 14.6. Also, a more dense set of points would be required than the 12 points represented in figure 14.6. Nevertheless, the character of the event could not be conveyed, no matter how dense the vector field.

Although some information about the shape of the ball can be gleaned from the instantaneous vector field (Koenderink and van Doom, 1975, 1976, 1978; Waxman and Ullman, 1985) and the assumption of rigidity can often be checked (Longuet-Higgins and Prazdny, 1980), the nature of the event can only be apprehended from the information contained in time-extended trajectories. The spatial distribution in the optical flow corresponding to the rolling ball changed over time in nonarbitrary ways, such that any

single sample in time of the spatial distribution could not be representative of the optical structure projected from the event. At endpoints of the trajectories, the ball momentarily stopped moving as it reversed direction and the optical flow field (instantaneously) ceased to exist. Along the trajectory, the point of maximum flow varied in its relative position within the contours of the ball's image. The flow field would not be strictly the same at any two points along the trajectory except at the two endpoints where the flow was null.

Rather than an insufficiency of structure, optical phase portraits contain an overabundance of structure that must be used to reduce the tremendous number of degrees of freedom associated with optical flows. The structure inheres in the forms of trajectory pieces and in symmetries existing across those forms. Of course, the symmetries or similarities of form must be noted to allow their use in reducing the degrees of freedom in optical flows. We have not ventured to describe processes instantiated in the sensory apparatus that would effect the measurements appropriate to uncovering symmetries and forms in optical phase space. Rather, by showing that the relevant properties of trajectories in events map into corresponding properties of optical trajectories and that such properties must be detected to recognize events, I have developed a job description for the sensory apparatus.

Personal information

1) What age category do you belong to: 18-25 ☐ 26-35 ☐ 36-45 ☐ 46-55 ☐ 56-65 ☐
2) Are you male ☐ female ☐
3) What is the highest level of education you hold?
Junior high school ☐
High school diploma ☐
Trade School ☐
College diploma ☐
University degree: Bachelor ☐
Masters ☐
PhD. ☐
4) Are you a Canadian Citizen? yes ☐ no ☐
5) Is English you first language? yes ☐ no ☐
6) If no what is your first language?_____
7) Have you ever served jury duty before yes ☐ no ☐

Knowledge Bias

1) Are you familiar with the basic method of producing animation yes ☐ no ☐
2) If yes please describe _____
_____
_____
_____
_____

3) Are you familiar with 3D animation yes ☐ no ☐
if no please go to question 5
4) How familiar are you with 3D animation:
a) I have seen at least 1 3D animated film
b) I have seen 4 or more 3D animated films
c) I have used 3D drawing software
d) I understand simple wire frames and texture wrapping
e) I have worked with complex mesh, NURBS, or high polygon count forms
f) I am a professional 3D animator
5) Do you think animated characters will someday replace human actors? yes ☐ no ☐
6) Are you a member of the legal profession? yes ☐ no ☐
if no please move on to question 8.
7) If yes what position do you hold? _____
8) Have you ever testified in court? yes ☐ no ☐
9) Have you ever been called as an expert witness? yes ☐ no ☐
10) Have you ever been involved in court proceedings before? yes ☐ no ☐
11) If yes was your experience a positive one? yes ☐ no ☐
12) Have you ever seen animated re-enactments before on television, movies, video, or the internet? yes ☐ no ☐

Questions of the interview

Written:

Please describe in detail what you saw in the animations: _____

Please also describe the appearance of the characters in the animation. _____

male in truck _____

female _____

male in house _____

Questionnaire

On a scale of 1 to 7 Please rate the following. Circle one number for each question.

What was the mood of the first male who arrived on the scene? (man in the truck)

not at all angry — very angry

1 2 3 4 5 6 7

not at all aggressive — very aggressive

1 2 3 4 5 6 7

not at all hostile — very hostile

1 2 3 4 5 6 7

not at all curious — very curious

1 2 3 4 5 6 7

not at all jealous — very jealous

1 2 3 4 5 6 7

What was the mood of the second male in the animation?

not at all angry — very angry

1 2 3 4 5 6 7

not at all aggressive — very aggressive

1 2 3 4 5 6 7

not at all hostile — very hostile

1 2 3 4 5 6 7

not at all afraid — very afraid

1 2 3 4 5 6 7

not at all jealous — very jealous

1 2 3 4 5 6 7

What role did the female play in the animation

In love with first male (man in truck)

not at all — very much

1 2 3 4 5 6 7

In love with second male

not at all — very much

1 2 3 4 5 6 7

Responsible for actions of first male

not at all responsible for all

1 2 3 4 5 6 7

Responsible for actions of second male

not at all responsible for all

1 2 3 4 5 6 7

What was the mood of the female in the animation?

not at all angry very angry

1 2 3 4 5 6 7

not at all aggressive very aggressive

1 2 3 4 5 6 7

not at all hostile very hostile

1 2 3 4 5 6 7

not at all provoking very provoking

1 2 3 4 5 6 7

How real did you feel the animation was depicted?

not at all real very real

1 2 3 4 5 6 7

How real did you feel the lighting was depicted?

not at all real very real

1 2 3 4 5 6 7

How real did you feel the textures of the house were depicted?

not at all real very real

1 2 3 4 5 6 7

How real did you feel the textures of the characters was depicted?

not at all real very real

1 2 3 4 5 6 7

How real did you feel the motion of the camera was depicted?

not at all real very real

1 2 3 4 5 6 7

How real did you feel the motion of the characters was depicted?

not at all real very real

1 2 3 4 5 6 7

Were you sympathetic to any of the following characters?

first male(man in truck)

not at all sympathetic very sympathetic

1 2 3 4 5 6 7

second male (man in house)

not at all sympathetic very sympathetic

1 2 3 4 5 6 7

female

not at all sympathetic very sympathetic

1 2 3 4 5 6 7

Who was responsible for the woman's death?

first male(man in truck)

not at all responsible totally responsible

1 2 3 4 5 6 7

second male

not at all responsible totally responsible

1 2 3 4 5 6 7

Ballot form

Who is guilty for the death of the woman? First male or the Second male or None or Both?

What should the sentence be:

First male (man in truck)		Second male (man in house)
_____	Accidental death 1-3years	_____
_____	Manslaughter 3-5years	_____
_____	Homicide 6-10years	_____
_____	Premeditated murder 10-more	_____

Appendix 5

Data from the first and second question of the interview

Light

1. Red truck goes by house. Woman by front of house. Truck comes by front and parks. Man gets out of truck woman still by front of house. Man and woman argue. Man from truck throws woman to ground and goes in to house and up stair. Second man exits room down hallway from top of stairs with gun. Second man shoots first man while first ma still is on stairs, fires 2 shots. Repeat of last scene from a different angle. This time see green indication of shot path, hitting the woman as she goes to rise. Before the bullet hits, she seems to be unharmed from the previous encounter with the first male. Woman dies.

Male in truck: T-shirt, pants, drives red truck, age between 17 & 30.
Female: Short brown hair, age between 17 & 30.
Male in house: Holding green weapon, shirt pants age ~ same as first.

2. I saw a truck driving up to a house, the first male jumped off the truck and went up to the porch. The female came out of the house and starting to confront the first male. They seemed like they are arguing and the first male was physically pushed the female to the side. The female then fell on the ground. The first male started walking in to the house after he pushed the female over. The second male ran from the bedroom carrying a gun and he started shooting at the first male who was just at the staircase. Two gun shoots were fired. The first male got hurt in the stomach. However, the two bullets went passed the door and accidentally shot the female on the floor. The female got hurt and she fell down immediately. The female was assumed to be dead at the scene.

Male in truck: He was aggressive in the way he confronting the female.
Female: She was scared and tried to push the first male out of the home. She seemed like she doesn't want him to be there.
Male in house: It looks like he was furious in the way that he was running out of the room with a gun.

3. The man in the truck drove up to the woman's home. She confronted him, told him to leave. He hit her and went into the home. She fell inside the house. The second boyfriend confronted the first. The second had a gun. It seemed they argued/struggled and the second boyfriend shot the first. He fired 2 shots. One missed the first boyfriend and hit the women as she was getting up from falling after being hit.

Male in truck: Blond hair.
Female: Brown shoulder length hair, blue pants.
Male in house: Brown hair.

4. The first man arrived at the home. The woman came out of the house where a confrontation occurred between her and the first male. The woman was pushed down in a struggle. The first male proceeded to enter the home he went up the stairs. The second male came around the corner and confronted the first male with a handgun. Shots were fired the first male was wounded. More shots were fired and the woman who was starting to get up off the porch was hit.

Male in truck: Muscular built male, blond hair, probably over sic feet.
Female: Brown shoulder length hair, slim build, probably around five feet or slightly over.
Male in house: Slighter build than first male, shorter the male in truck, dark hair.

5. What I saw was a man in a truck drive in and confront the woman in a hostile, aggressive manner. I saw he was very jealous and could not deal to see the woman with another man. I saw that the woman was not happy to see he ex-boyfriend and questioning him why he is here. But the ex-boyfriend being so big and strong pushed the woman over and she fell to the ground. After dealing the woman, the ex-boyfriend decided to confront the current boyfriend and without really having a conversation starting shooting at him. The poor fellow didn't even have a chance to do anything since the ex-boyfriend came so abruptly. As they fought and while the current boyfriend fired to get away, the girl was shot in the process. And she went down very very slowly.

Male in truck: He was a big, buff, strong guy who looked like he wouldn't let anyone pass by.
Female: A normal housewife. She didn't look wimpy or fragile. She looked like a woman who does get out.
Male in house: He seemed like a normal ordinary guy. Not to skinny and not overweight.

6. Man drove up in a red truck and pulled up to the right hand side to the entrance of the building (house?). He walked up to the entrance and a female "met" him at the door. There was a struggle which ended by the male front the truck throwing the female onto the ground (pushing her by her head). As the female fell the male entered the residence. While walking through the entrance the male residence ran through a hallway with a fun and stopped before the male from the truck. Two shots were fired, the second one seeming to strike the male from the truck in his left shoulder. Two more shots were fired. The second striking the female (just getting up from the ground in the outside of the entrance) in the back of

the head.

Male in truck: Wearing light green shirt, dark green pants, blond, Caucasian.
Female: Red shirt, blue pants, brown hair, Caucasian.
Male in House: Light blue shirt, darker blue pants, blond, Caucasian.

7. 1 male drives up to the house in a truck. A girl comes out on the porch trying to stop him from entering the house. The man from the truck strikes her down. Upon entering, I saw a second male, from within the house approach the top of the stairs, infront of the entrance, with a gun in his hands. He aims and shots at the man from the truck. Both shots miss the man from the truck, but because the front door is open, as the lady who was lying on the porch is getting up, the second bullet hits her and she goes down.

Male in truck: Short, preppy, blonde hair, clothes causal pants and crew shirt, white male over 20 years.
Female: Should length brown hair, clothes casual pants and t-shirt, white female. over 20 (not a teen nor older person).
Male in house: Longer slicked back brown hair, also wearing pants and shirt, white male over 20 (Less attention paid to actual appearance of animation characters b/c they're not real).

8. A male drives up to a house in a truck. He exits the truck and approaches the house. A woman appears from the house and tries to push away the male (in truck). The two of them wrestle and the male pushes the woman to the ground. As the male (in truck) enters the house , another male approaches the door front the hallway of the house with a gun. He proceeds forwards the male (in truck) and shoots two shots towards him. One of the gunshots accidentally hits the female while she is on the ground. One shot hits the male and wounds him.

Male in truck: Blonde hair, cut short.
Female: Brunette, long hair.
Male in house: Brown hair, long.

9. Did not write a description.

Male in truck: -
Female: -
Male in house: -

10. First man approaches house and is stopped by female. Man hits female who then falls to the ground. First man enters house and is hot at by second man. Shots hit woman and kills her.

Male in truck: Green pants, white man.
Female: White female, brown hair.
Male in house: Blue pants, white male.

11. Man arrives at house in a truck. Enters the house. Met by ex-girlfriend. Knocks girlfriend down. Enters house with gun. Shoots at other boyfriend. Bullets come from inside house and hit girlfriend.

Male in truck: Can't remember specifically.
Female: Can't remember specifically.
Male in house: Can't remember specifically.

12. Guy in truck drives to house assault women then goes inside. Different guy in house comes with a gun, running to find his girlfriend on the ground and some angry guy inside the house. Guy with the gun shoots the intruder and shoots again hitting the women in the head. The intruder is also hit.

Male in truck: Angry & disturbed.
Female: Frightened and upset.
Male in house: Protective, concerned.

13. Man in car drove up to the house, was confronted outside by the woman, a scuffle ensued in which the woman was thrown down and then the man in the truck entered the house. The man in the house had gotten a handgun while the man in the truck and the woman were arguing outside. When the man in the truck entered the home, the man in the home came running down the hall and fired two shots at the man in the truck. One bullet then struck the woman in the head as she was trying to get up.

Male in truck: White male, average to tall muscular build.
Female: Shorter female small frame.
Male in house: White male.

14. Truck cam to house - man (blonde) left truck at which time women approached at door. Fight at door outside house - man (blonde) pushed woman - who fell to ground. Blonde man entered house -

second man in house came down hallway with revolver. Turned women and fired shots - one shot but man and one shot missed but hit women at which time she fell to ground. Man blonde was up standing. End.

Male in truck: -
Female: -
Male in house: -

15. A man in truck drives up to a house, he exits his truck and tries to enter the house. A woman outside the house tries to prevent him and is assaulted. She is thrown down outside the front door. The man then enters the house and is meet by a 2nd man on the staircase who has a gun. The 2nd man fires 2 shots one high, missing the 1st man & exiting out the doorway. The 2nd shot hits the 1st man, passes thru him and entering the head of the prone woman.

Male in truck: Caucasian male, wearing lt. Gr. Shirt, dk gr. Pants, light brown hair.
Female: Caucasian female, wearing red top w/blue jeans, dk hair.
Male in house: Caucasian male. Wearing lt. Blue shirt, dk gr. Pants, brown hair.

16. I saw a sunny day with a bungalow house. Nothing happens until a red truck very antique looking appears on the right of the screen and then turns out onto the front. A blonde male, stocky, blue jeans and T-shirt gets out and walks towards the door. A female comes out. She is brunette. She comes towards the man. She pushes him and they struggle. The blonde man hits the woman. She falls down and stays there. The blonde man enters the house. Inside the house, a brunette man is running through the house carrying a gun. The blonde man is at the bottom of the stairs. The brunette man is hidden by a wall. He runs to the top to the stairs and fires 2 shots. One, I assume, hits the man but the blonde man doesn't fall. The other shot goes out of the house and into the woman's head.

Male in truck: Blonde, jeans (blue), T-shirt, stocky, walks funny.
Female: Brown bob cut, slim, T-shirt, jeans.
Male in house: Brunette, moustache, dark shirt.

17. The man in the truck pulls up to the house to confront his ex-girlfriend's new boyfriend. Much to the chagrin of his ex-girlfriend, he enters forcibly and encounters the man in the house armed with a gun. Two shots were fired one into the ex-boyfriend another fatally wounding the woman.

Male in truck: His feet were not always smooth stable with the ground, somewhat robotic. Angered, pre-

occupied.
Female: Same. Begging. She still cared for her esc.
Male in house: Fed up. Vigilant, passionate.

18. Man in the truck (man 1) arrive @ the house and was confrontational. He was met by the woman outside the front entrance and an argument ensued. The argument resulted in physical contact between male 1 and the woman. The woman was pushed to the ground and man 1 entered the house for an unspected reason. The man in the house (man 2) came to see the nature of the disturbance and was carrying a firearm. When he approached man 1 he fired 2 shots. The first shot injured the man 2 and the second shot killed the recovering woman on the front step.

Male in truck: Approx 6' 3", medium to heavy build, dark hair.
Female: Approx 5' 6", long dark hair, shim build.
Male in house: Approx 6' 0", med to light build, blond hair.

19. 1st male drives up to house, the female comes onto the porch. The 1st male leaves truck and moves onto the porch. The female runs up to the 1st male and attempts to prevent him from entering the house (they appear to argue). 1st male pushes to female to the floor and proceeds to enter the house. 2nd male comes down the hall with a gun turns the corner and seeing the 1st male entering the house fires 2 shots the first is high the second lower. Outside the house the woman is attempting to get up when she is struck in the head by the 2nd bullet.

Male in truck: Blonde, short hair, tall, dark pants with a light green shirt. Drove and older model red truck.
Female: Medium height, medium length brown hair, wore blue jeans and a red/purple top.
Male in house: Medium length brown hair wore a light blue shirt and dark pants. Was tall.

20. Male in red truck. Blond hair – 6' 3" pulls in front of residence. Gets out of truck proceed toward woman in attempt to get to other male in house. In process male in red truck pushes female to the ground. Male in house proceeds down hallway toward other male #1 and begins firing (3 or 2 shots) one of which hits woman in front entry way. All shots miss other male.

Male in truck: Green shirt, blonde hair, Caucasian, 6', 3".
Female: Caucasian, 5' 5", brunette.
Male in house: 6' 0", dark brown hair.

21. Male in truck drive, push woman to ground, enter house (open door I think?) 2nd male walks down hall

with gun in hand, approaches 1st male and shoots 2 bullets. One hits man in truck, second hits woman outside house.

Male in truck: Jeans, blond?, clean shaven, long shirt, strange walk cycle (ha, ha)
Female: Black hair, nice figure.
Male in house: Jeans short shirt.

22. I observed a man angrily descending from a truck. He met a lady who apparently was asking him to go back. Forcefully the man descending the truck went into a house after forcing the lady to fall down. When the men entered the house, he was confronted with another man wielding a gun, which accidentally went off and hit the lady outside who was at the time getting up from the floor where she had been. The lady immediately fell down and died.

Male in truck: Furious and uncontrolled.
Female: Angrily pacifying.
Male in house: Hostile and vengeful.

23. 3 people. 2 males. 1 seem ex boy of female - man in truck. 2nd seen male man in house. Antecedent ex boyfriend threatened to kill girl + man. Man in truck comes to see girl to persuade/get involved? Pushes girlfriend down new boyfriend comes out and shoots man. 2 shots fired.

Male in truck: White male.
Female: White red shirt.
Male in house: White.

24. Man arrives in truck. Female confronts him and tries to keep him from entering house. The man is very hostile and aggressive as evidenced by his throwing her to the ground. He enters the house and tries climbing the stairs but is confronted by the second man who is around. Shots are fired in what appears to be self defense toward the man from the truck. Several shots are fired before the intruder is immobilized but a stray bullet appears to strike the woman in the head. It would appear to be a care of self defense with the unfortunate complication of accidental death of the woman.

Male in truck: Blonde hair, green pants.
Female: Mid length hair - brunette. Dark red tops. Dark green pants.
Male in house: Dark hair. Green shirt.

Texture

1. The scene opened with a shot of the house. After a few seconds a truck drove and drove around from the side and parked in the front. A man got out of the truck and made his way towards the front door at which time a woman came out and began to fight with him. The man from his truck pushed the woman to the ground and entered the house. Upon entering the house a second man came running down the hallway with a gun. He fired two shots from the top of the stairs. One shot hit the man from the truck, while the second hit the woman who was sill outside in the head.

Male in truck: was wearing a plaid shirt.
Female: She was wearing a black shirt and blue jeans. She had long dark hair.
Male in house: He was wearing a green shirt and blue jeans.

2. I saw the ex-boyfriend drive up to the house, have a confrontation with his ex-girlfriend, push her down, and then enter the house. The second male, the current boyfriend came down the hall carrying a firearm and shot down the stairs at the ex-boyfriend. The bullets proceeded to exit the house, one of which struck the woman.

Male in truck: Blond, red plaid jacket.
Female: Brunett wearing jeans.
Male in house: Brunett.

3. Firstly a truck with a male driver pulled up in from of a rural house. As the man got out of the truck a female exited the house to try and stop the driver from entering the house. As she tried this the male threw the female to the ground and proceeded into the house. As the man entered another man appeared don the hall. As the two males could see each other the second male pulled out a gun and shot two bullets in the first males direction. Apparently the two shots missed and then hit the female who was still lying on the ground outside the door.

Male in truck: Working class man between the ages of 20-50. Around 6' tall and 200 pounds with very large hips and stomach.
Female: Middle class lady between the ages of 16-40. She had large hips as well and weighed around 125 pounds, 5' 5" tall.
Male in house: Middle class man between the ages of 20-50. Around 6' tall and 170 pounds.

4. A man arrives at a house. A woman appears. They seem to argue and exchange physical actions.

The man seems to knock the woman down and proceeds in to the house. The second man appears to be carrying a gun and is located in a corridor on the second level. He seems to be keeping himself from the front door view. The first man appears unarmed enters the house and proceeds up a small flight of stairs to the second level. As he does the second man appears at the top of the stairs and fires a gun at the first man. The first man appears to have been hit by a bullet and falls backwards into a corner. The second man fires two other shots and hits the woman who is still on the floor outside the front door.

Male in truck: Casually dressed. Check shirt. Jeans.
Female: White shirt. Casually dressed.
Male in house: Grey shirt. Casually dressed.

5. House, late afternoon. Truck pulls up. Man in red walks out. Women comes out of house. Some manner of confrontation occurs between man in red and woman. Woman knocked to floor. Man in red proceeds inside. Man inside confronts man in red on the stairs. Two shots fired by man inside. First shot passed over the head of the man in red. Second shot appears to pass through or passed the torso of the man in red. Same shot goes on to strike the woman (still struggling to get up) in the head and kill her.

Male in truck: Blonde, red flannel long-sleeved shirt, light blue jeans.
Female: Brown hair, black blouse, black pants, 2 inch heals, pearls.
Male in house: Black/brown hair, light blue shirt, black pants.

6. Man in truck arrives at house. Seems to be in frenzy. Woman comes out to intercept him, likely to avoid confrontation between males. They struggle 1st male throws female to ground and enters house. 2nd male emerges from hallway and with little discernible provocation other than trespassing, fires two shots at the 1st male. The second shot strike the fallen female in the head killing her.

Male in truck: Blond, red shirt, jeans.
Female: Brunette, black shirt, brown pants.
Male in house: Brown hair, grey shirt, black pants.

7. Ex shows up. Short discussion with female at porch. Ex throws her to the floor. Ex runs into house, goes up stairs as current boyfriend comes to confront with a gun. Current fires as soon as he sees ex. Current fires several times. I can't recall when or if it was apparent when the ex was hit. Part way into gunfire, female is shown getting up and is shot in process and falls again. Unclear if female had been wounded previous to this shot. If not supposedly she would have gotten up earlier. Or was she hurt by the tussle?

Male in truck: Red shirt, muscular.
Female: Black clothes, shapely.
Male in house: Muscular.

8. I viewed a fairly choppy animation involving 3-D constructed images of a house (interior and exterior: porch, main floor and upper floor landing), truck two males, and a woman. At times these images appeared transparent. The sequence of events enacted by the images are as follows: (Ext front of house) a truck pulls into view from behind the home (viewer's right) and ——— and stops in front of house. A man exits the truck (strange because a man's image begins to exit on the right, then disappears_ on the driver's side and approaches house while a woman is seen at the large front window looking out (presumably at the man from truck) – (Ext view of porch) the man approaches the front door while the same woman seen in window rushes out the front door, they meet, woman appears to attempt to block the man from walking forward, the man knocks woman (strike to side of head with man's right arm) down and proceed into the house as the woman lies dazed on porch. (interior: bottom of stairs) "truck man" rushes up the stairs. (interior upper landing) as man rushes up stairs another man is seen approaching from hall (to the –man's left) with a gun in left hand, the second man aims and makes two shots at truck man who drops to his knees. (ext. side view of porch) the woman lies where she dropped, two shots fling over her head (shown by green lines) as the second one passes over her. She raises her head which is struck by the "bullet": she lies down and is presumably dead.

Male in truck: Black shoes.
Female: Brunette, slim build.
Male in house: Black shoes.

9. 2 story house with a veranda - street lamp and gas tank - red truck pulls up - man in suit gets out of truck - woman leaving house, walks (runs?) out on to veranda - man approaches woman - woman hits man (although this contradicts the idea of the man and woman as a married couple, this is how the animation appeared to me) - man hits woman throws woman to the ground (if female is assailant, as it first seemed) to me, the man hits the woman to the ground; although, with the succedent knowledge of the assailant with the gun inside the house, the situation would rather fit the stereotypical paradigm of fleeing woman being saved by her husband, in which case his throwing her to the ground could be read as an attempt to keep her out of danger). The man enters the house and begins to climb the stairs as the armed man runs down hallway towards the flight of stairs - man with gun turns corner, sees man, fires gun (possibly aimed at man or woman or both) - man ducks - bullet hits

woman in head - woman hits ground - fade to black.

Male in truck: Light hair, average build, wearing suit.
Female: Dark hair, dark clothing, average build.
Male in house: Dark hair, armed, blue jeans (?), heavy set.

10. The man in the truck entered the property, pulled up to the (back?) door and was confronted by the female. The two looked as if they were verbally engaging each other. Both were approaching each other, with the male walking faster , and confronted each other on the porch. Both stated to push and shove each other until the male either pushed or struck the female in the back of the head, knocking her to the ground. The male proceeded through the door and up to the stairs but was met halfway by the other male who appeared at the top of the stairs with a gun. The other male fired two shots, one of which, I think went through a window and struck the female, who was still on the porch. Prone on her knees.

Male in truck: The male in the truck appeared aggressive in hi approach towards the female and entering the property.
Female: Combative towards the man in the truck and then either hurt or disorientated after being struck.
Male in house: Either aggressive or panicked based on the speed of which he fired shots.

11. House is set-up suggesting rural as ranch style house (acreage), especially given the large tank (propane?) and pine trees. Somewhat aggressive nature of man in truck is depicted through rapid truck entrance and bold exit. Woman appears to be waiting for him. First male appears only interested in confronting man-n house. Though aggressive, first male never appears threatening to either the woman or the second male. Woman appears interested only in preventing confrontation between the men. Second man appears very defensively aggressive (his response appears reasoned, though a bet heavy-handed). His shooting of the first male appears unprovoked, though given the aggressive entrance of the first male, his mental state may have played a bigger part than any physical provocation. The bullets appear to pass through the first male (one does - the other misses his head) and strike the woman in the head, killing her. The second man appeared to "shoot first, as questions late".

Male in truck: Young, "rural", aggressive, physical, domineering, threatening, confrontational.
Female: Older, concerned, peace-making, struggling, crying, desperate.
Male in house: Aggressive, tough, muscular, defensive, unwilling to negotiate, hot-headed.

12. Saw a white hose with four collums and 3 windows and a door. To the right of the house there was a white cylinder that I assumed was a diesel gas tank. A truck drives up from the right and behind the

house and stops in front of the house, front of the truck faring the house. A man in a red plaid shirt and blue jeans gets out and heads towards the door of the house. A woman in black jeans and black shirt comes out of the house and fights with the man. They tussle together until the woman is thrown to the ground and the man runs into the house. He climbs the staircase up to the second floor. A dark haired man is seen hidding down the hall with a fun. As the man in the red plaid shirt reaches close to the top of the stairs the dark haired man jumps out from the hallway and shoots two shots down the stairs at the man in the plaid shirt. It misses him but one of the shots hits the woman who is still on the ground outside and kills her. She slumps and we see the man in the red plaid shirt on the stairs and the woman lying on the ground.

Male in truck: Blond, red plaid shirt, blue jeans white male.
Female: Dark shoulder length black hair, black T-shirt black pants. White Female.
Male in house: White male dark hair, blue jeans and blue shirt.

13. I saw a red truck parking in front of a camp house from which a tall male came out. The male was Blonde, white, wearing flannel checkered re/black shirt and blue jeans. After he came out of the truck he tried to enter the house but he was stopped by a female at the door. The female looked average height shot hair to the chin bone and dressed all in black. The female and the male struggled for a few seconds until the male hit the girl once down to the floor and then entered the house. Inside the house another male, tall, white, dark-haired came out from one of the rooms with a gun (pistol). This male was wearing a blue/dark vertical striped shirt and dark pants. The male with the gun ran from the room to the stair way at the entrance to meet the other male that just entered the house. The male with the fun seemed to threaten the intruder and shot twice at him, but seemed to miss the shots. Nevertheless one of the shots passed over the intruder and hit the female (which still was outside, getting up front the floor) and shot her on the head, killing her.

Male in truck: Tall, blonde, white, and wearing a red and black checkered flannel shirt and blue jeans.
Female; Average-height, white, hair long to the jaw bone, all wearing in black.
Male in house: Tall, white, dark-haired, and wearing a blue/dark vertical-striped shirt and dark pants.

14. House. Truck (red) drives up from behind house + parks in front. Male gets out of truck. Woman emerges from house struggle with man + is knocked down – remains outside. Man from truck enters house, goes up entrance stairs. Second man comes down hallway from left, encounters man coming up stair. Man inside house has gun, shoots several (4 – 5?) + misses, Bullets strike man on stirs and woman outside who is attempting to get up.

Male in truck: Male, brown hair, brown plaid shirt.
Female: Dark hair, dark clothing.
Male in house: Male, darker hair, grey or blue shirt.

15. I saw the ex-boyfriend coming over, the girlfriend coming out of house (perhaps pushing and asking him to leave), the ex-boyfriend hitting her and knocking her down, then entering the house. The ex was going into the house, the current boyfriend was coming down the hallway, turned the corner and fired the gun several times, in the direction of the ex-boyfriend. He also could have been shooting at the girlfriend, however I think that was accidental, but over rage or jealousy he, in the heat of the moment shot the ex on purpose. The last event to occur was the girl falling to the ground.

Male in truck: red truck, I think he was wearing a hat, tall guy.
Female: Brown hair, tiny lady, black clothes.
Male in house: Jeans, big guy, blue T-shirt.

16. I saw a man in a truck come out and knock his exgirlfriend over and then he went into the house and the current boyfriend came out shooting his gun, probably at the exboyfriend but he missed and shot the girl. Then she rolled over and died.

Male in truck: Red shirt, blue jeans, brown hair, taller and bigger than girl.
Female: All black clothes, slender, medium length brown hair.
Male in house: Brown hair, black pants I think.

17. A man pulled up to a house in a red truck. As he got out of the truck a woman came out. They met at the front of the house and seemed to argue. The woman tried to prevent the man from coming inside the house. He knocked her down in order to get inside. The "truck" man walks up the stairs. Another man inside the house hurries toward him, as they meet the man in the house points a gun at the man (truck man) and tries to shoot him. (It's unclear whether the man meant to kill him or just to wound him). The 2nd bullet hits the woman in the head. I think that the explanation of who the characters were (boyfriend, ex, girlfriend) influenced how I saw the characters.

Male in truck: Macho, angry.
Female: Pleading.
Male in house: Anxious, purposeful.

18. A man in a truck pulled up to a house – a woman came out – there was a physical confrontation in

which female pushed to the ground. The male then entered the house where a second man came from the hallway with a gun in hand. The first man was at the base of the stairs and the second with the gun began firing shots. A shot came out the door and hit the female as she was getting up off the ground. The female fell to the ground again and was bleeding.

Male in truck: Red jacket? Light brown hair?
Female: Slim, long dark hair black pants and shirt.
Male in house: T-shirt, pants/jeans dark hair?

19. House, somewhat isolated. Truck arrives. Man exits truck, walk to house. Woman exits house. Verbal battle, physical struggle. Woman knocked down. Man enters house. Second man moves toward entranceway, gun in hand. Second man stands some 3-4 feet away from first man & fires two shots. First shot horizontally angled may have hit first man, goes over the head of prone woman, outside the door. Second shot hits woman in head. Second man is positioned higher than first man.

Male in truck: Red jacket, blue pants, blondish hair. Light complexion, moderate build.
Female: Dressed in black, short sleeved top, dark shoulder length hair.
Male in house: Dark haired, heavier built, blue shirt.

20. First male in truck arrived @ house. The woman came out of the house she pushed him & he through her to the ground. He proceeded to enter the house & goes up the stairs where upon the second male appeared with a gun. He fired @ the first male & appeared to hit him. Meanwhile the female still outside stood up at this point she was shot.

Male in truck: Red plaid jacket, blue jeans, looked a bit like the guy doing this test, blond hair.
Female: Long dark hair, black clothes, pants & short sleeved shirt.
Male in house: Blue shirt, dark hair, tall physically fit.

21. Exboyfriend drives up to house. Girlfriend comes out, they speak. Exboyfriend pushes girl away, she falls to the ground. Boyfriend hears comotion, comes to stairs. Exboyfriend starts up the stairs, boyfriend pulls pit a gun and starts shooting. Shoots exboyfriend and when girlfriend starts to get up from the ground a bullet accidentally hits her and kills her.

Male in truck: Tall, dark hair, medium frame, wearing blue shirt.
Female: Medium height and body frame, dark hair and light brown skin wearing black.

Male in house: Tall, dark hair, medium body frame, wearing yellow shirt.

22. First scene, a rural home, a red pick-up drives to the front door of the home. A lone male exits the truck and walks to the door of the home. A female confronts the truck man on the front porch and there is a struggle, the female falls to the floor. The truck man enters the house, and is inside the door when the house-man appears at the top of the front stairs with a gun. The house man fires the hand-fun at the truck-man, two shots are fired. They do not appear to be fatal shots. Then the animation moves to a different point of view, to the woman on the porch. At the instant the shots are being fired, the woman is trying to get up and is hit by the stray bullet.

Male in truck: Red truck, plaid shirt.
Female: Brown hair.
Male in house: -

23. Man #1 arrived in a truck and approaches house. Girl walks out front door to meet him, to reason with him. She struggles to stop him from entering the house. He throws her to the ground and enters the house. Man #2 hears that Man #1 has entered and Man #2 comes around corner with his gun and immediately shoots at Man #1 twice. The girl was shot accidentally but under wreckless conditions.

Male in truck: Tall, broad shoulders, hunched over wearing a red loggers shirt, cocky and determined about age 30, not smart.
Female: Confused, frantic, thin pretty dressed in tight t-shirt and pants, brown hair, about age 3o, helpless and emotional.
Male in house: Dark hair young, about age 30, less brawly than the first male, unflinching, determined, unafraid, not very intelligent.

24. A white duplex. Then a red truck drive around from an off road, park in front of the duplex. A man (ex-boyfriend) dressed in a plaid logger jacket aggressively get out of his red truck (seemed tome he had red hair as well) agressively go up towards the door as female (all in black, black skirt, heels) exits house – some form of struggle (physical) between these two- exboyfriend throws her down and enters house. Current boyfriend (also in black) comes down hall way toward ex-boyfriend w/a gun – He fires 2 shots a exboyfriend. Couldn't make out the effect of the first shot on exboyfriend. (Was informed he was wounded). Second shot struck girlfriend. She struggled a bit and then lied down. (dead as we have been told).

Male in truck: Reddish hair. Taller frame, muscular frame/Caucasian/ wearing red plaid logger jacket &

blue jeans.

Female: Auburn hair, shoulder length, black below the knee skirt, black blouse, high heels. Medium frame.

Male in house: Black hair, medium height & frame black pants/black shirt.

Motion:

1. Man #1 arrives in pickup truck. Man #1 enters house & encounters woman. Man #1 strikes woman, knocking her to floor. Man #1 proceeds to 2nd level & encounters Man #2. Man #2 is armed with hand-gun. Man #2 stops man #1 on stairs as he is coning up. Man #2 fires two shots at man #1 on stairs. Man #1 is hit with one shot & the woman is hit by 2nd shot. It appears that 2nd shot kills the woman.

Male in truck: Large frame, taller than woman.
Female: Slight build, shorter than Man #1.
Male in house: Medium or slight build, may have been younger or shorter than Man #1.

2. Truck rounding corner, man exiting truck man entering house, slaps woman to ground, another man running down hall with gun, fires at first man hits woman in head - she dies.

Male in truck: Looked like a man bent on hurting someone.
Female: Looked like a woman who was upset and angry.
Male in house: Looked like a man with a gun in a hurry.

3. This vignette depicts a domestic dispute which involved 3 people. The man in the truck triggered the episode when he left his truck and approached the house. The woman confronted the intruder. The second male came to her defense. The owner of the gun was not careful of its use. The gun and its owner were responsible for the death as well as the person who shot it. Details about the gun, the "murder" weapon, were not made clear in the animation. More evidence would be required to proceed with a trial.

Male in truck: Only slightly more realistic than a child's "stick-figure".
Female: Easily identified as a female but no indication from the video about her mood of motivation.
Male in house: Somewhat older than other two characters, but "just appeared" as if he were simply playing a role.

4. House in country - red truck approached & parks in front. Man leaves truck & enters house. Female approaches male, they argue, male strikes female and forces her to the ground. Male goes up the stairs. Second male comes along upstairs hallway. Both males meet at top of stairs. Second male had handgun, fires several shots at first male. Bullets enter area where female is on floor. She is in process of standing up then falls down again. Scene ends.

Male in truck: Tall - darker confection.
Female: Tall - black hair.
Male in house: Same height as other male.

5. A man drove a old model pick-up truck to this farm house after parking the truck at the front entrance, he walked into the house angrily with a shot gun. Without ringing the door bell, he pushed open the door and rushed in. He was confronted by a woman who try to stop him. She was later knocked down by this man after a short argument. The man then went further to look for the woman's current boyfriend. As the second man come out of the bedroom, he was fired upon twice but missed. Unfortunately the second shot hit the woman who was lying on the floor.

Male in truck: Tall, 6' in height, slim built. Short hair. Wearing jeans and driving an orange old model pickup truck.
Female: Tall & slim.
Male in house: Fat ~ 260 lb.

6. A man arrived in a truck. He was greeted at the door by a woman. They had a disagreement, she fell to the ground. He left her & entered the house. He was greeted at the stairs by a second man. The man in the house pointed something at the man on the stairs. The female was struck by a projectile while on the ground.

Male in truck: Poor posture. Bowl legged.
Female: Slim & curvey - blue jeans.
Male in house: Tall upright posture with a green weapon.

7. Man in truck assault woman knock her down. Attempt to assault man in house. Man in house protect himself by use of gun. Shoot man in truck and accidently kill woman.

Male in truck: Tall 6' plus, 220 lbs. late 20's,
Female: 5' 5" - dark hair, slight build.
Male in house: Tall 6', 190 lbs. late 20's.

8. Man in truck drives up goes in house. Woman confronts man in truck, he pushes her to the ground. Man in truck runs in to the home with gun, sees man in house, pulls out a gun and shoots at man in house. The I think man in house get hit or something. The woman falls to the floor.

Male in truck: -
Female: -
Male in house: -

9. Man in truck pulls up to house. Confronts the woman, a shot struggle ensues. Woman is struck down. Man in truck continues through the house with gun. Confronts man in house. Two shots are fired. Shot one goes over man in house's head. Shot two appears to pass through arm of man in house and then into the head of the woman resulting in her death.

Male in truck: Dark hair, light T-shirt, jeans.
Female: Brown hair, red shirt, jeans.
Male in house: Red hair, tan colored T-short, jeans.

10. I saw man in truck force his way past the ex-girlfriend and enter the house. Man in house then came up the stairs to see what was happening and was then confronted by and shot be the man in truck. I then saw shots fired again front the top of the stairs which hit and apparently killed the woman.

Male in truck: White male, short brown hair, no glasses, possibly between 5' 9" and 5' 11" in height, average weight.
Female: White female shoulder length brown hair, average height and weight.
Male in house: Similar to man in truck but lighter coloured hair.

11. A guy drove up to an isolated house in a red truck and proceeded to enter the house. When her entered the house he was quickly confronted by a woman. What looked to be some sort of argument and tussle ended up with the woman being thrown or knocked to the floor without getting up. The man (1st) then proceeded up a set of stairs. A second man with a handgun came down a hallway towards the stairs where he fired some shots in the direction of the first male. The woman seemed to be trying to get off the floor while bullets were flying around her and then she collapsed again.

Male in truck: Avg build.
Female: Brunette with shoulder length hair, avg build.
Male in house: avg. build.

12. exboyfriend entered the house and struggled with the woman - she was left on the floor. Ex-continued

into the house meeting up with the new boyfriend. I saw a shot hit the woman, but could not till who fired it. Based on what we were told before seeing the film, I would assume that the ex was responsible for the shooting. We were told only two shots were fired, so the camera must have shown us the same period of time from two different angles.

Male in truck: Tall & thin, dark clothing.
Female: Dark hair, dark pants, red shirt??
Male in house: light hair?? stocky build.

13. A person (man) arrived at a house & entered. A woman tried to stop him from coming in , he hit her & she fell. The man went toward a stairway where he was stopped by another man carrying a gun. The man with the gun shot at the intruder & appeared to hit the woman as she was attempting to get up.

Male in truck: Determined, angry, pushed his way in.
Female: Angry, trying to get man out of her house.
Male in house: Protective, concerned. Carrying a gun for a reason.

14. A man arrives @ a house in a red truck. He enters a car port & encounters a female who he struggles & pushes down. He proceeds into the house & encounters a man upstairs who approaches him with a gun. The man in the house fires the gun. The bullet hits the female in the carport.

Male in truck: Very hostile & angry.
Female: Angry.
Male in house: Also angry approaching intruder with a gun.

15. One man approaching a house in a truck. Arguing with a female inside. Slapping her, she fell to the floor. 2 men in conflict. I was confused who was who. Shots being fired.

Male in truck: Regular guy.
Female: Small figure.
Male in house: Regular guy without face and voice I have difficulty to relate to the figures.

16. A red truck drove up to the house. A man got out of the truck - went into the house. A woman approached the man. The argued, the man hit or forced the woman tot the ground. The man continued into the house. A second the man (carrying a gun) approached the first man. The man with the

gun fired 2 shots. One shot appeared to hit the first man. One shot went through the doorway & hit the woman. The woman was in the process of getting up.

Male in truck: Lt hair, dk pants, lt shirt.
Female: Dk hair, burgundy shirt, dk pants.
Male in house: Dk hair, dk pants, lt shirt, gun in hand.

17. I saw a man drive up to a house in the woods he then left the truck and entered the house. Upon entering the house, a women confronted him & they proceeded to argue. The arguing continued for a few seconds until the women was physically pushed (or punched) to the floor. The man from the truck then left that area of the house and proceeded to the second floor. As he climbed the stairs to the second floor, he was confronted by another man at the top of the stairs. The man at the top of the stairs had a gun and when the man front the truck was halfways up the stairs, the man from the house shot at him twice. One of these bullets struck the man from the truck & the other bullet struck and killed the woman. Unable to read expression.

Male in truck: Brown pants, shirt.
Female: Red shirt, pants.
Male in house: pants, shirt.

18. A trailer size house, trees n the right side, sistern or some other container on the right side. The driveway was also on the right. The red truck with the driver male came around the right of the house & parked. The driver went into the house. The female came down the stairs & tried to push him out. The male hit her & she fell down. The male ran up the stairs. The second male came from a back room, carrying a gun. He fired twice at the driver who was still on the stairs. He backed down the stairs. There were 2 more shots - both missed the man but one hit the woman in the head because she was just getting up.

Male in truck: Funny loping walk, brown shirt, black pants.
Female: Shorter than the driver. Shoulder length hair, slim build.
Male in house: Couldn't.

19. A red truck pulls up to a bungalow type house, upon where the man in the truck parks in front and exits his vehicle. He walks up to the house and enters without knocking. He seem to be walking briskly with big strides. When he enters the house a woman runs up to greet him and at first it look like they may be embracing but then there is some physical violence as they both hit each other and she gets knocked

down. The man continues into the house where another man runs out to meet him. The man from the truck fires shots at him and when the scene pans back to the woman, she is also shot by a bullet going through the wall.

Male in truck: Brown hair, looks like he is wearing jodhpurs.
Female: Slim, wearing pants, brown hair.
Male in house: Brown hair.

20. Ex-boyfriend physically forcing his way into the woman & current boyfriends home. He struck the woman & knocked her down in the process. Current boyfriend confronts the intruder (ex-boyfriend) with a gun & fired shot at him. One of the shots hit the woman.

Male in truck: Tall, in a shirt tucked into jeans.
Female: Dark hair, wearing slacks.
Male in house: Carrying gun.

21. The man (ex) is the red truck came to confront another woman & man. Man from truck & woman were struggling, man struck woman & knocked her down. Another man in hse heard what was happening, went with gun, fired at first man, shot the woman.

Male in truck: Quite large, tall, blondish hair, short sleeved shirt.
Female: Slim, shoulder length hair, brown hair.
Male in house: Tall, slimmer build than first man, dark hair, long sleeved shirt-rolled up.

22. 1st male drives up to house and gets out of the truck. He then goes into the house. When he gets inside the house the female runs up to him and trys to push him back out of the house. He uses force to knock her down and proceeds further into the house. The 2nd male then comes running out of another room in the house with a gun. When he encounters the first male he shoots twice at him, hitting him and the female who is in the next room.

Male in truck: Male build (large shoulders), wearing pants & shit, blond (?) hair.
Female: Dark hair, female figure (hips, etc.), dark clothing, pants, shirt.
Male in house: Same as male in truck except hair and shirt are different colors.

23. A single storey house set in a forest of pine trees. Late afternoon as mentioned by instructor. A red truck approaches the house, a medium dark haired man gets out and enters the house. The lady

of the house approaches the man, and words are exchanged, pushing and shoving ensues, and the woman is thrown down to the floor. The second man (current boyfriend), upon hearing the scuffle comes from and upstairs back room with a gun in right hand, and is met by the first man already half way up the stairs. Two shots were fired, one of which hit the ex-boyfriend and the other shot which looked to have hit the woman (who was jest getting up off the floor) in the head, causing her to roll over onto her back on to of her right arm, dead.

Male in truck: Medium brown hair, dark pants, tan shirt.
Female: Burgandy pants, possible, tan shirt, brow shoulder length straight hair.
Male in house: Wearing light colored clothing.

None

1. A man drove up to the house in a red truck (old truck) got out, walked up to the house, and reached the veranda. As he reached the veranda a woman came out of the house, and met him as he got there. After exchanging a few wards with each other, the woman struck the man in the chest, the he hit her, knocking her down. The man then proceeded in to the house and once he reached the entrance infront of a staircase he was confronted by another man who had come from a hallway perpendicular to the staircase. The second man held a gun and shot at the other man, (I think) 4 times all of the shots missed the first man but the last hit the woman who was still struggling to get up front the injury incurred to her by the first man. She was shot in the shoulder and collapsed to the floor upon impact.

Male in truck: Blond-brown hair. Well built (strong) green shirt jeans.
Female: Thin, Barbie-like, dark brown or black hair, purple shirt.
Male in House: Almost identical to the first man, perhaps the exact same but in different lighting.

2. I saw the man in the red truck pull up to a house. Just as he pulled up a woman was at the front door. The man in the truck got out and entered the house and a fight or argument broke out between the man with the red truck and the woman. The man with the red truck threw the woman down and began to move further in the house. Then a second man from inside the house, coming from a hidden area to the front, came and confronted the first man and with a gun he (the second man) shot two bullets at the man (with the truck). One hit the man and another hit the female just getting up from the ground, in the back of the head.

Male in truck: sandy hair, 5' 8" or 9', light blue shirt.
Female: mid length hair darker 5' 6"
Male in house: didn't really see clearly.

3. Man in truck arrives at scene. Woman approaches man and struggles. Man wins the struggle and immediately walks inside the house. A second male approaches the intruder and shoots at the intruder. The second shot hits the woman.

Male in truck: Green shirt walks like a redneck
Female: Young woman with medium hair.
Male in house: Man

4. Man in truck drives up to the house and enters house. Woman is at door and has confrontation with man in truck whereupon man in truck throws the woman to the ground. Man in house comes running to the entranceway with gun and fires two rounds at the man in truck. One of the bullets strikes the woman in the back of the head as she is trying to get up.

Male in truck: Grey shirt, brown short hair, brown/black pants.
Female: Shoulder length brown hair, black pants, bluish? shirt.
Male in house: This male appeared to me to be no different than the man in truck.

5. A male drives up to a house in a red truck. A female appears at the door. The male approaches the female; she lunges at him but apparently to prevent him from entering. The male throws the female to the ground and enters the house. A second male arrived with a gun appears from within the house, approached the (red truck) male and opens fire. Two shots are fired, both appears to have missed the male but one stray bullet hits the females head as he is attempting to get up and appears to have killed her.

Male in truck: Caucasian
Female: Caucasian
Male in house: Caucasian

6. Man drove up in a late model truck. Enter the house. Put the woman aside, on floor (no indication of conversation). Second man ran toward the entrance from inside the house. Second man fire 2 shots at man from truck. Missed (no indication of intention to miss). The shot hit the woman (no indication of entry wound).

Male in truck: Bow legged.
Female: Good texture.
Male in house: Similar to 1st mans clothing.

7. There was a truck that pulled up to a house, Male (A) (the person in the truck) approached the house to encounter a female. The female struggled with Male (A). The male left the female on the ground. Male (A) continued to go throughout the house continued up the stairs, Male (B) who was already in the house scrambled towards the stairs. In Male (B) possession was a fire arm. When encountered Male (A). Male (B) fired 2 shots both shots missed Male (A). The first shot missed both Male (A) and the female who was still on the floor. The second shot fired, the female was starting to stand up. This shot missed Male (A) but hit the female.

Male in truck: Over weight, short hair, stagger as walk, grey shirt.
Female: Smaller, brown hair.
Male in house: Younger male, short sleeve shirt, blue pants.

8. The man in the truck (former boyfriend) drove up to the house. The woman come to the door, the man in the truck approached her. They started hitting each other and he knocked her to the ground. He went upstairs and was met by the man in the house (present boyfriend) who had a gun. The man in the house began to shoot at the other man. Both of the bullets reflected off of the wall in the stairwell and shot the woman in the head who was at the bottom of the stairs.

Male in truck: Darker figure, couldn't tell very much about him.
Female: Dark figure, not very distinguishable.
Male in house: White shirt, blue pants, light skin.

9. The old boyfriend drove up to the girl's house to confront her. She was mad and tried to push him out or away from her. He hit her and she fell to the ground, wounded but not totally unconscious. The old boyfriend then went looking for her new boyfriend to confront him. He had his gun out before he began talking to him and shot at him without much delay or hesitation. One of the bullets hit the girl in the head on the floor, although the gun was aimed at the new boyfriend. I don't think any bullets hit the new boyfriend.

Male in truck: Large and stalky with bulky middle, dark hair.
Female: Shorter and thin with medium length dark hair.
Male in house: Average. (Don't remember).

10. There seem to have been a truck waiting on the side of the house, waiting for someone in if to open the door. Once a person is seen coming out of the house, the truck backed out and a man came out of the truck, making his way through the house. There was a dispute with the man and woman. The man knocks out the woman. Then making his way into the house, he approaches another man who seemed to have a gun. The man with the gun open a couple of shoots, accidentally on shoot was directed at the woman's head and presumable the woman could be dead.

Male in truck: Tall, clean cut, in dark clothes.
Female: Green t-shirt, brown hair.
Male in house: Had a gun.

11. The guy in the truck went to a house where his ex-girlfriend and her boyfriend were. The guy in the truck struck his ex-girlfriend and she fell then he went somewhere else in the house. The guy in the house fired a gun at the ex-boyfriend and the bullets hit the girl, killing her and injuring the guy (but he didn't look very injured).

Male in truck: Tall, dark hair.
Female: Shorter than guy in truck.
Male in house: White shirt?

12. As 1st male approached in truck female open door. 1st male then came out of his truck struggled and struck the female to the ground. She remain lying on the ground possibly unconscious as 1st male proceeds into the house. With a gun 1st male sees 2nd male and shoots twice towards the male. The second shot hits the arising female and she collapses back on the ground.

Male in truck: Large build, light clothing, Caucasian, short hair.
Female: Shoulder length hair, slim build, slightly shorter than the 1st male.
Male in house: Caucasian, short hair, large build.

13. A man drove up in a truck and got out. A woman met him at a door. The man went straight into the house. At first it seemed as if they were hugging as soon as they got inside but then it seemed as if they were struggling. The man threw the women to the ground. He then went in to the next room and shot a man and this man fell down. Bullets then flew through into the room were the women was. Because she was getting up I assumed this was this was happening at the same time as the man was getting shot. So I thing the women was killed by the same bullets that killed the man.

Man in truck: Large, square.
Female: Small, finer features.
Male in house: Large, square.

14. I saw a guy (male in truck) went to a female's house and the female doesn't want him to get in. And then they have a fight, he pushed her to the floor. Then the guy went to upper stair, the guy (male in house) brought a gun and shoot the first guy.

Male in truck: Have a red truck.
Female: Long hair.

Male in house: -

15. The man in the truck drove up to the women's residence. She came to the door and tried to stop him from entering. He pushed her inside and struggled with her for a minute before pushing past her. He went up the stairs and the man in the house met him at the top of the stairs with a gun. The man in the house fired 2 shots one hitting the women who had been knocked to the floor in the previous struggle.

Male in truck: Walked very awkwardly up to the house.
Female: -
Male in the house: -

16. A man in red truck stops at a house as a women walks out. They go into the house but the women asks and pushes the man to leave. The man then pushes the girl and she falls. As the man walks up the stairs the second man comes out of a room with a gun and shoots at the first man. The gun shot hits the girl as she tries to get up. She is killed.

Man in truck: Brown hair, black pants, walks weird.
Female: Black, chin length hair.
Man in house: -

17. An angry man drove up to the house and stormed into the house. The first person he came across was his ex-girlfriend - there was a fight and he finally knocked her down with a blow to the face. He then proceeded to go further into the house and found his ex-girlfriend present boyfriend Coming up the staircase. The ex-boyfriend (or man in the truck) fired 3 shoots and missed. A struggle began between the male in the house and the man from the truck. In the struggle random shots were produce and accidentally shot the female and next was slowly get up after being struck down.

Male in truck: Ex-boyfriend.
Female: Girlfriend.
Male in house: Present boyfriend.

18. Boyfriend #1 approaches the house and barges in. Woman comes out and starts swatting him. He karate chops her, she falls to the ground. He runs to the next room, but slows down as soon as he walks through the door. Man #2 runs toward him with a water pistol and fires green bullets. I saw three bullets come out. In the first room, the woman is still rolling around on the floor. Both green

bullets seem to fly over her head and hit the wall. Then she dies.

Male in truck: You could see his face, but dressed the same as man #2.
Female: Looked like a silhouette.
Male in house: Looked like the man in the truck. They were running at the same pace when the camera switched scenes.

19. A suburban house (a bungalow) - no view of neighbouring houses. A red truck pulls up and a woman comes to the front door. It is unclear at this point if she attempts to lock the door or not. The man from the truck enters into the front room and the two (women + man) begin to fight (physically lashing out at one another). The man sends a blow to the women's head and she falls face first onto the ground. Meanwhile (or shortly after) another man (in the house at the time of the incident) sneaks towards the front room via a hallway, carrying a gun. The man from the truck is unaware of his presence until he emerges from the hallway, confronts him and fires twice. The shots travel through the doorway into front room - the first passing over the woman's head as she is beginning to rise from the ground, and the second hitting her in the back of the head. We can deduce from the nature of the attack that the shots were not intended to harm or kill the woman.

Male in truck: 5 ft 10" - 6 ft. Dark trousers and a dark green t-shirt. Short hair, brown. He had a very funny walk!
Female: 5 ft 6" - 5 ft 8 ish (I think!) Dark clothing - pants + a short sleeved shirt. (This dancing woman is throwing me off!) She had should width hair, straight "bob" like.
Male in house: This guy looked very similar to the other guy - maybe darker hair.

20. House on a street. Red pick up truck pulls up to front door. Woman standing at front door. Man gets out of truck. Both female and male enter house. Argument in hallway of house. Male strikes female. She falls to ground. Male goes upstairs. Another man in house approaches from the upstairs w. a gun. Man in house shoots gun 3 times at man from red truck. Female is struggling to get up. One of the bullets accidentally hits the female and kills her.

Male in truck: Heavier/stocky build, average height.
Female: Younger, slender.
Male in house: Unknown.

21. A man driving a truck came around the corner and stopped infront of a house. A person appeared in the doorway. The man in the truck got out of his truck and went in to the house with the other

person. The other person was woman. They argued and fought in the front foyer, the man throwing the woman to the floor. He then went up the stairs. As her was coming up the stairs another man come down the hallway with a gun in his hand. He turned towards the man coming up the stairs and shot at him. It seems that the man going up the stairs was missed by the gunshot. But the lady downstairs, who was getting up off the floor, got shot in the head and died. The End.

Male in truck: Husky, tall, looked hunched over.
Female: Simple, average height, brown/black hair, skinny wearing jeans and a fitting shirt.
Male in house: Paid little attention to his appearance! Average height, younger than other man.

22. A red truck pulled up to a house and a man gets out of it. He is not by a woman in the doorway. He enters and there are moments of fighting until the woman is knocked onto the floor. The man starts to go up the stairs. A second man comes running from an upstairs room and meets the first man at the top of the stairs. The second man had a gun and begins firing at the first man. Several shots were fired but missed. More shots were fired and he was hit. Just at that moment the woman regains consciousness and begins to try to get up off the floor. One of the shots that missed the man hits her in the back of the head.

Male in truck: Medium build, short hair.
Female: Shoulder length hair.
Male in house: Larger to medium build, short hair.

23. Man in truck arrives at house just as woman appears in door of house. Male 1 pushes and wrestles with female - she pushes (in entrance of house interior) back (they argue?) he pushes her down - she hits the floor. Male 1 runs upstairs and confronts male 2 (male 1 carrying a handgun). Male 1 shoots - male 2 ducks the shot (1 of several (3 or 4?) shots). One of the shots flies past male 2 and strikes female in back of head as she is getting up off the floor - she is killed as a result.

I couldn't tell that male 2 was injured buy a shot, I think male 1 intended to kill male 2, but not the female. It could be manslaughter because the "stray" bullet hit the female. (ie. It was not aimed directly at her).

The questions about "love" and "responsibility" could not be answered as a result of seeing the clip - they would be inferences.

Male in truck: Stocky - "cowboy" type - bow-legged - distinctive gait. (shirt + pants).
Female: Slender - shoulder length hair - wearing slacks + sweater.

Male in house: Slender but otherwise hard to distinguish from man in truck.

24. A red truck turned around a corner and park in front of the white house with black roof at the corner. A woman came out of the house before the red truck parked. A man from the truck (man A) stepped out from his car and walked briskly and angrily towards the woman and push her inside the house. The woman pushes the man (A) and hit him on his chest. The man A pushed her and slapped her on the face. The woman fell on the ground with her face landed by the entrance door/ The man A neglected her and walked strongly to the staircase that lead the ground level of the house. Man (B) came out from a room, rushed across the corridor with a hand gun in his right hand and started shooting toward the direction of man (A) and also the direction to the front door. Man B fired 3 times, one shoot hit man A; upper body. The camera shifted to the entrance where the woman was. More was 2 more shoots, the shooter was unidentified, but one of the bullet hit the woman. While she was struggling to get up from the floor. She struggled a bit and finally lied down with her back on the floor.

Male in truck: Brown hair, medium weight, tan wearing greyish T-shirt, silver bucket belt and dark (black) pants. White male black hoes.
Female: Brown skin, black hair, medium weight, wearing a T-shirt, dark blue pants, black flat shoes, hair is straight and shoulder length.
Male in house: White male, dark hair, medium to slim, wearing shirt and pants, carrying a hand gun.


Acceptability of re-enactments
of crime scenes
DISK information
Installation instructions
University of Alberta
Gerry Derksen
01.10 2001
Gerry Derksen Thesis: Animated re-enactments
Disk TWO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